THE OHIO STATE UNIVERSITY

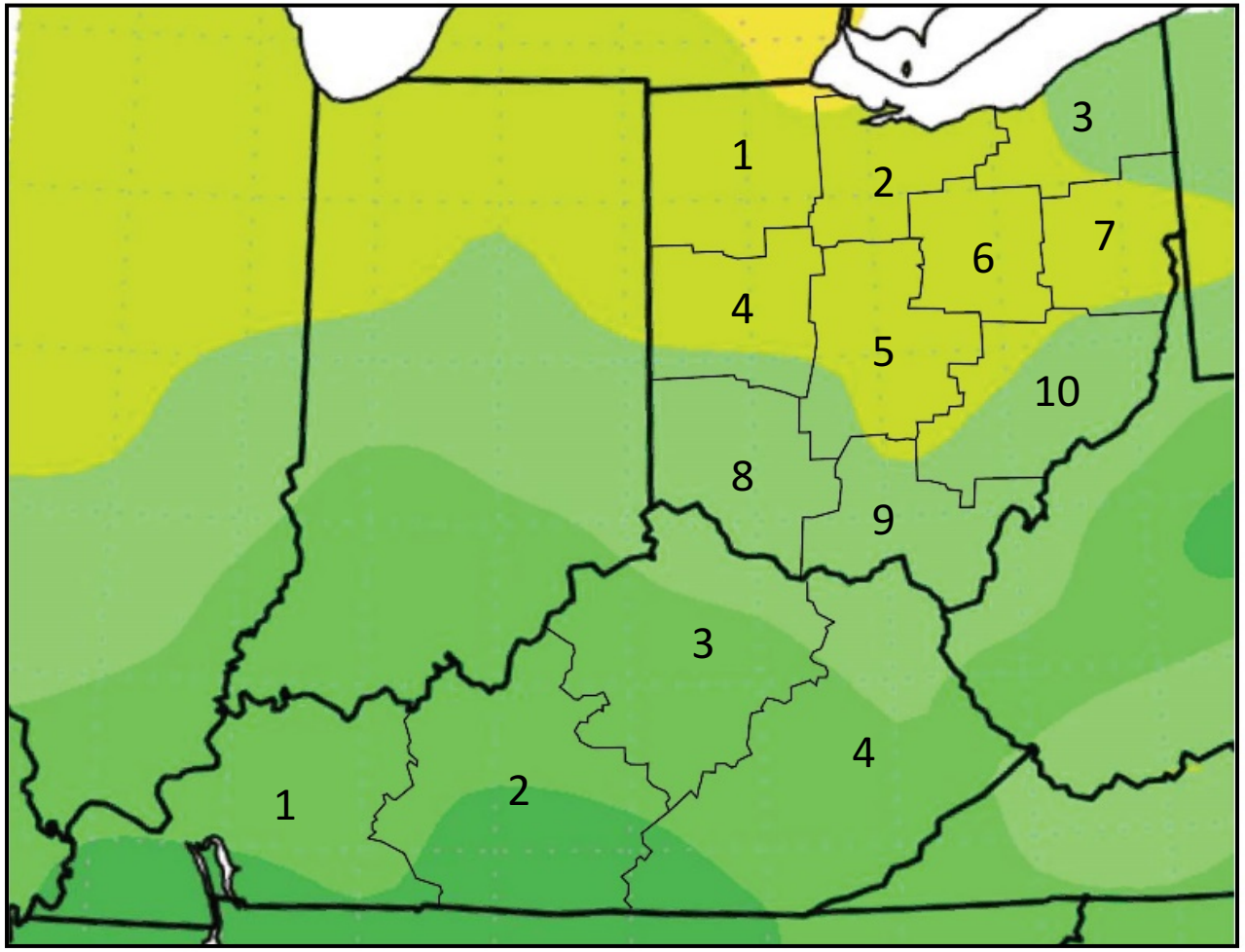
State Climate Office of Ohio (SCOO)
OSU Extension
Byrd Polar and Climate Research Center

Current Drought Conditions & Climate Outlook
Historical Drought Overview For Kentucky/Ohio

Jim DeGrand (ASC) and Aaron Wilson

Web: http://bpcrc.osu.edu/hydro

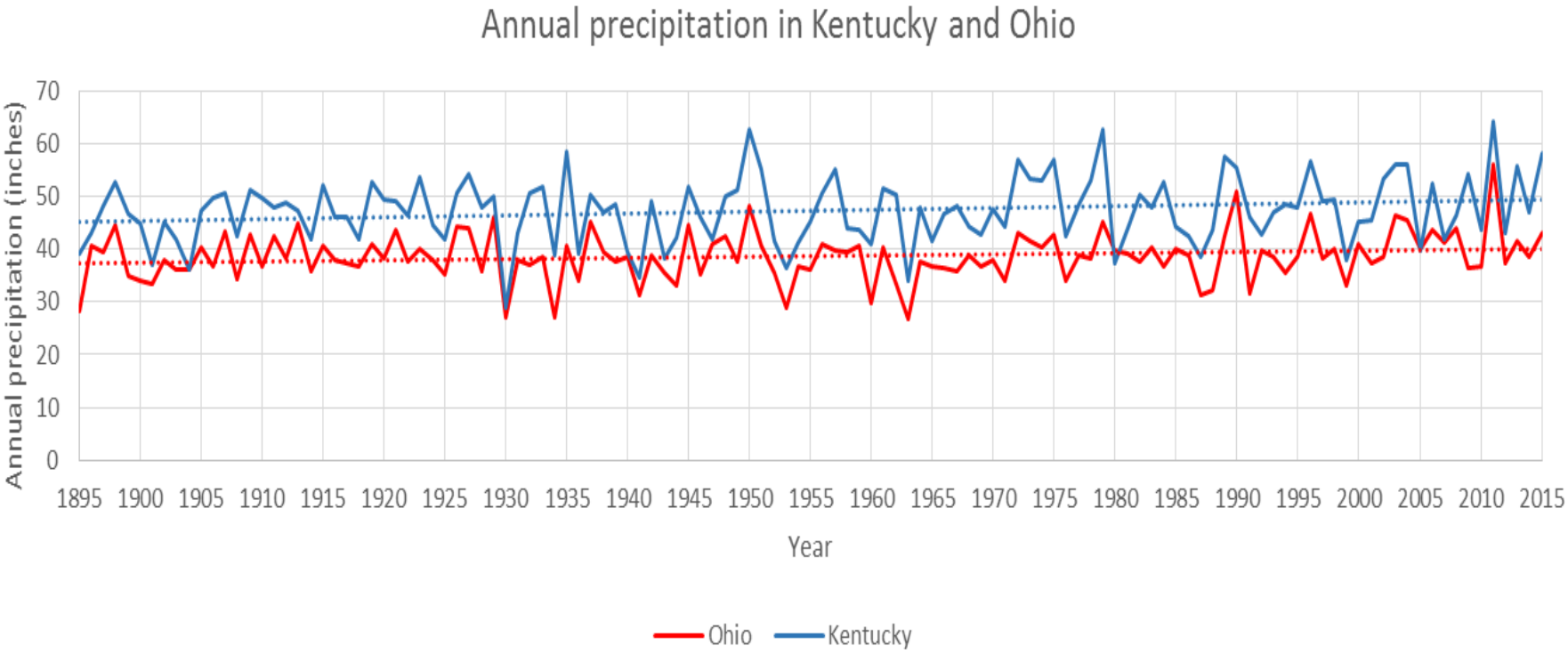
Annual precipitation



1981-2010 annual precipitation (inches)

Midwestern Regional Climate Center
cli–MATE: MRCC Application Tools Environment

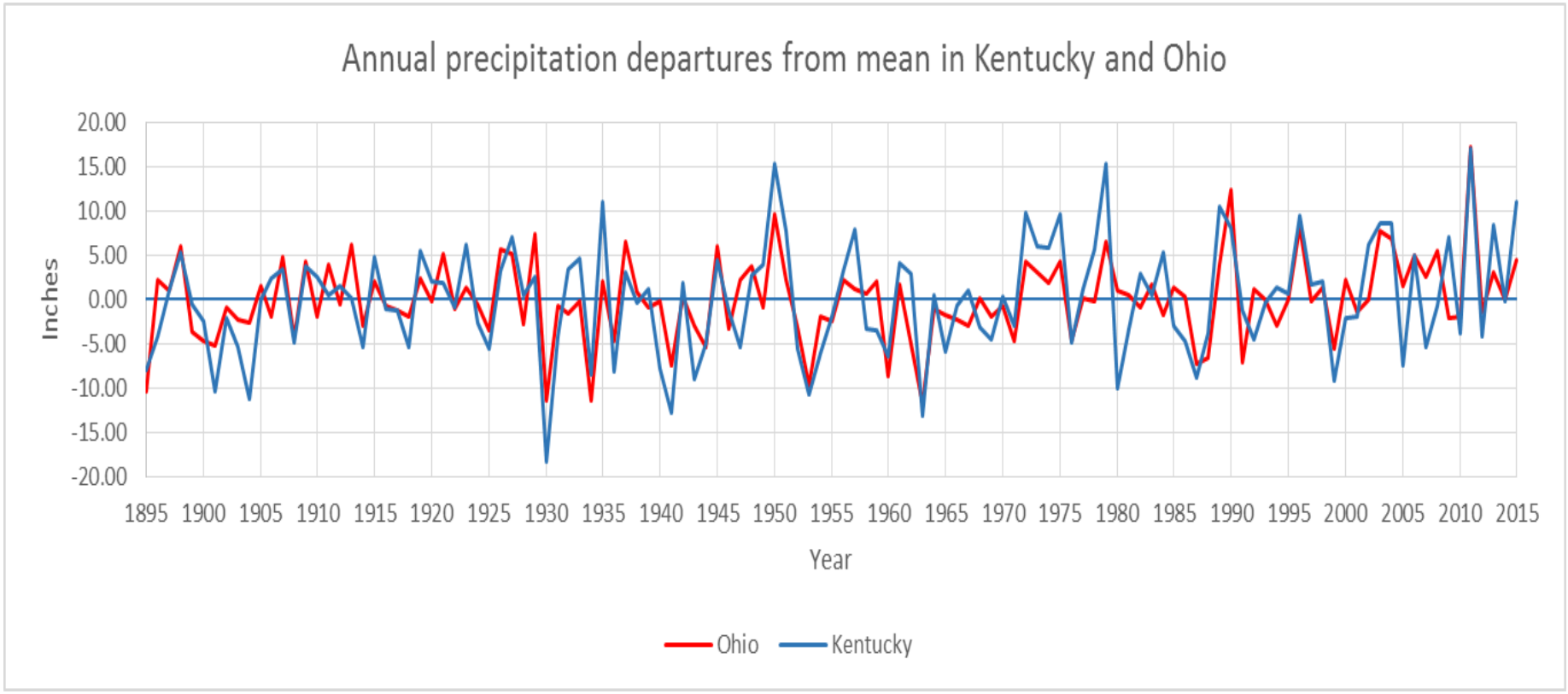
Annual precipitation



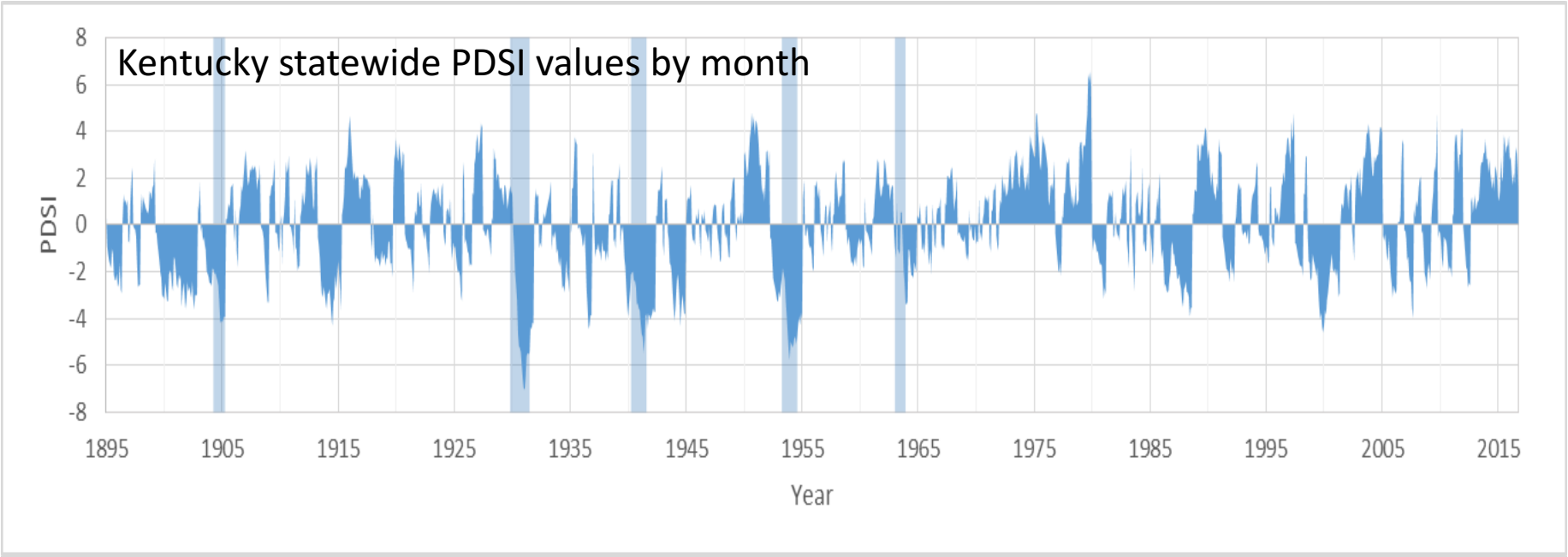
	Trend
Kentucky	0.035”/year
Ohio	0.023”/year

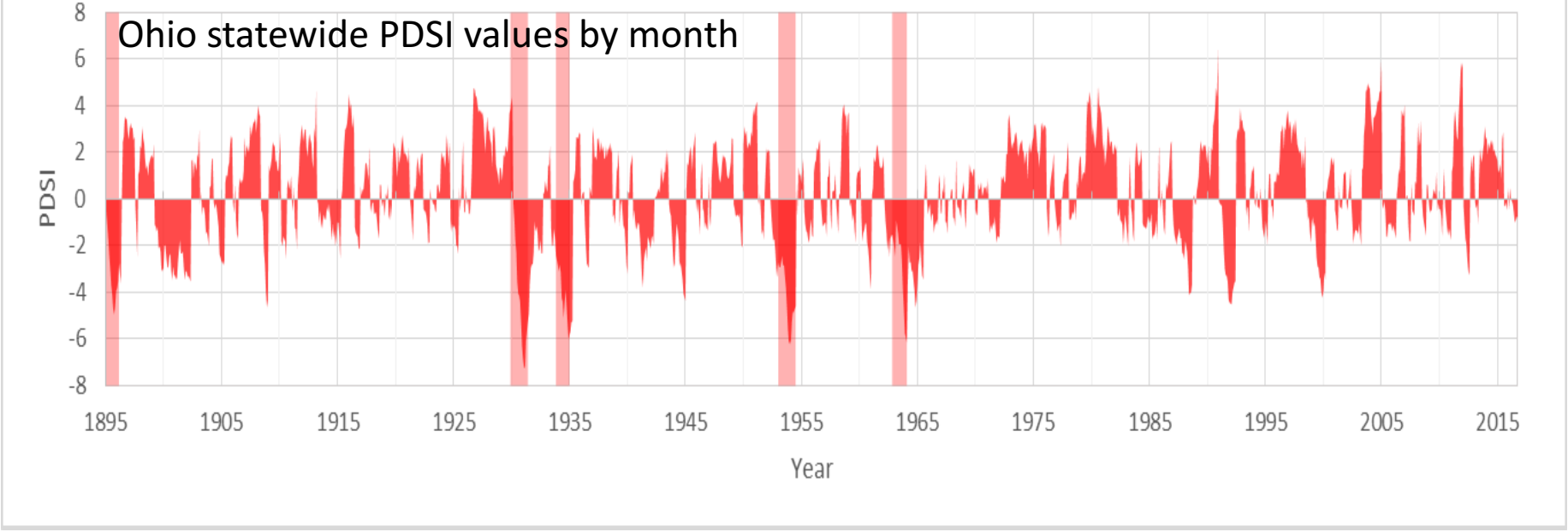
Overall mean	1901-1930	1981-2010	Percent change
47.33”	46.44”	47.90”	3.15%
38.66”	38.77”	39.45”	1.75%

Precipitation: departure from the mean



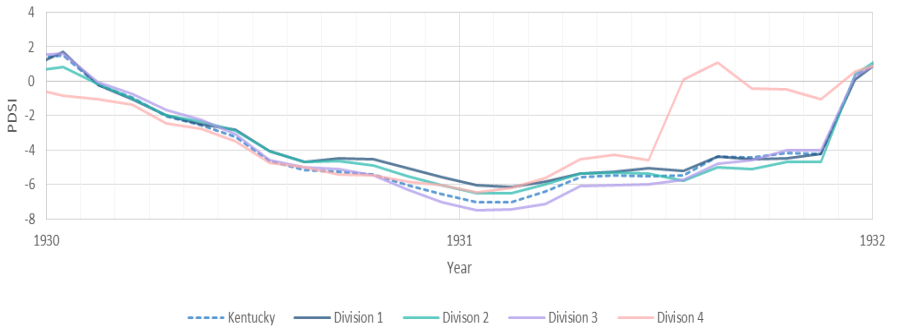
Drought severity



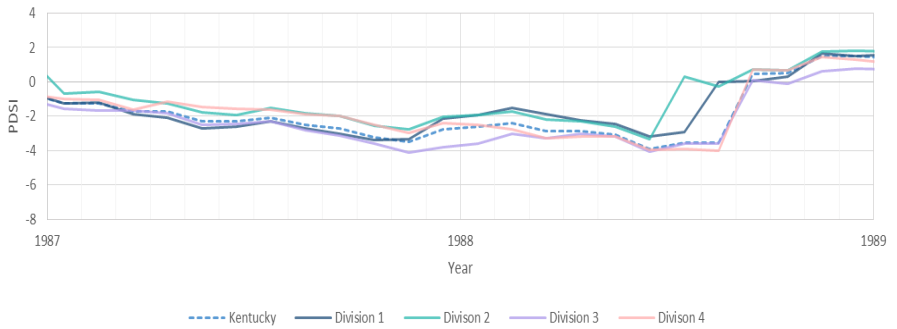


Individual drought events - Kentucky

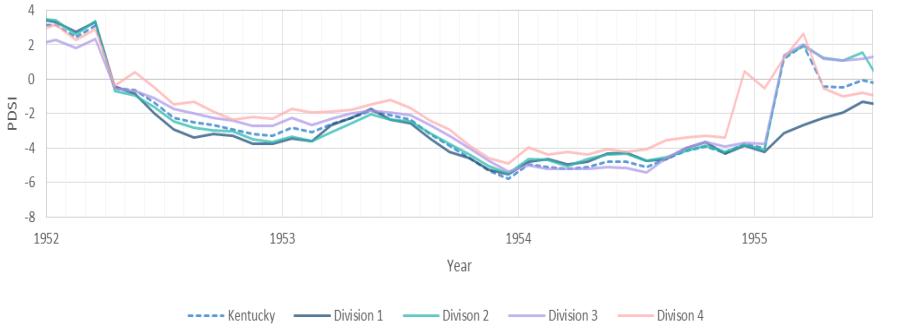
1930-1932



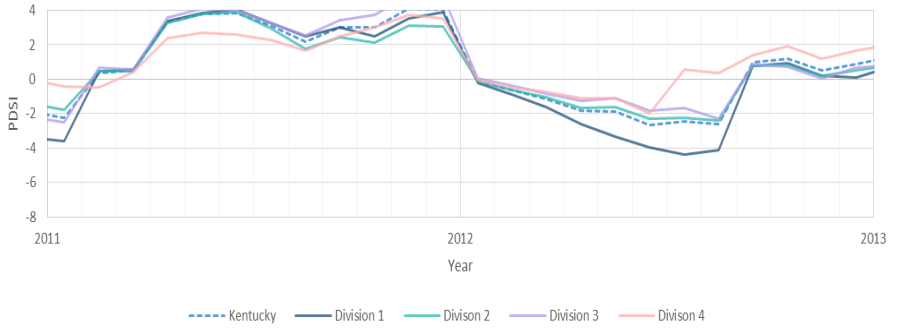
1987-1989



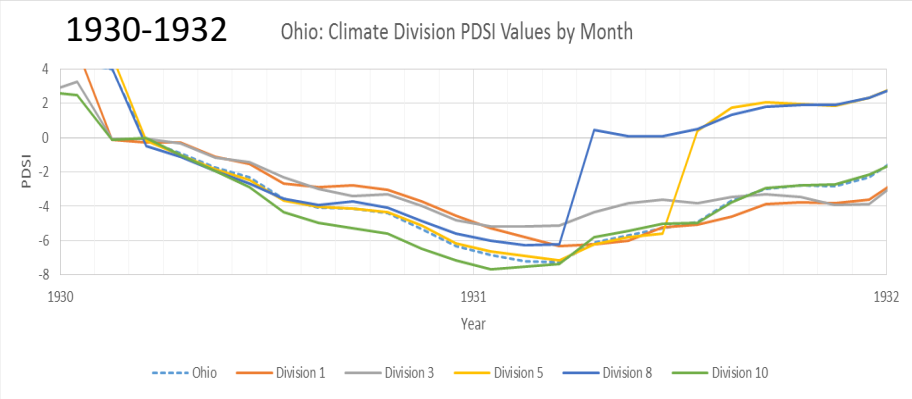
1952-1955

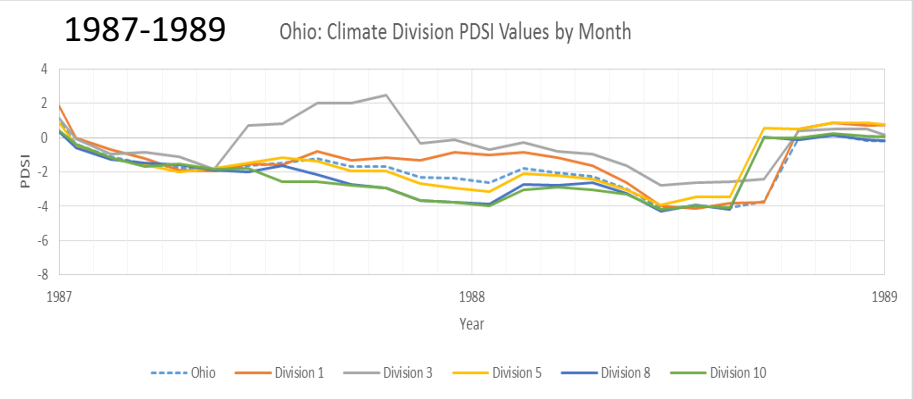


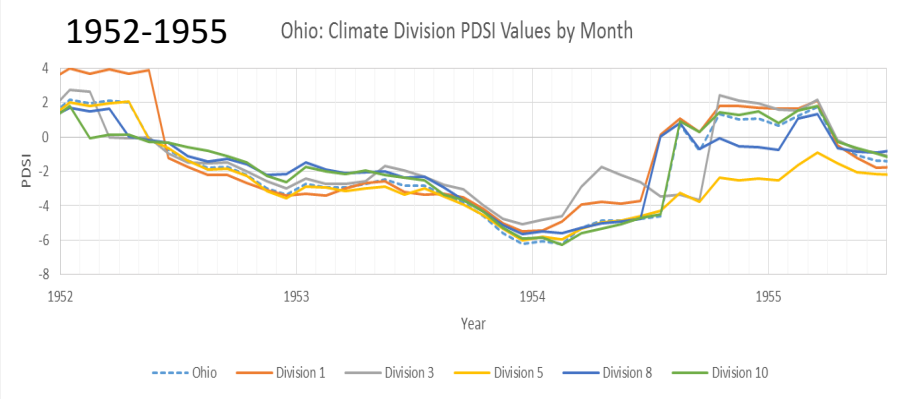
2011-2012

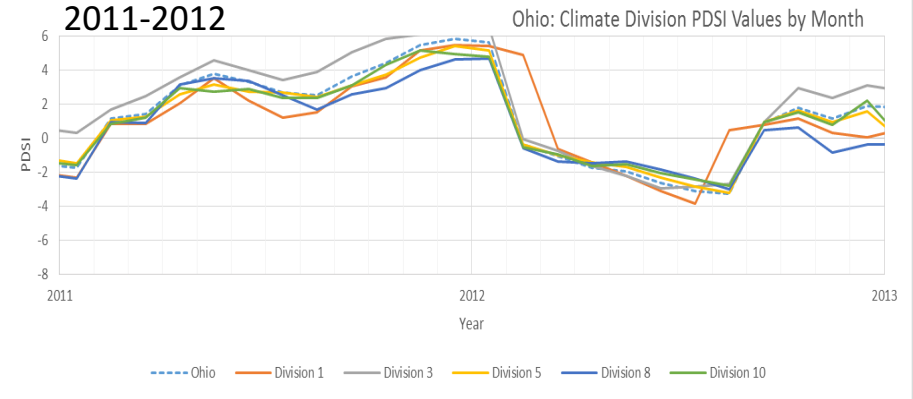


Individual drought events - Ohio

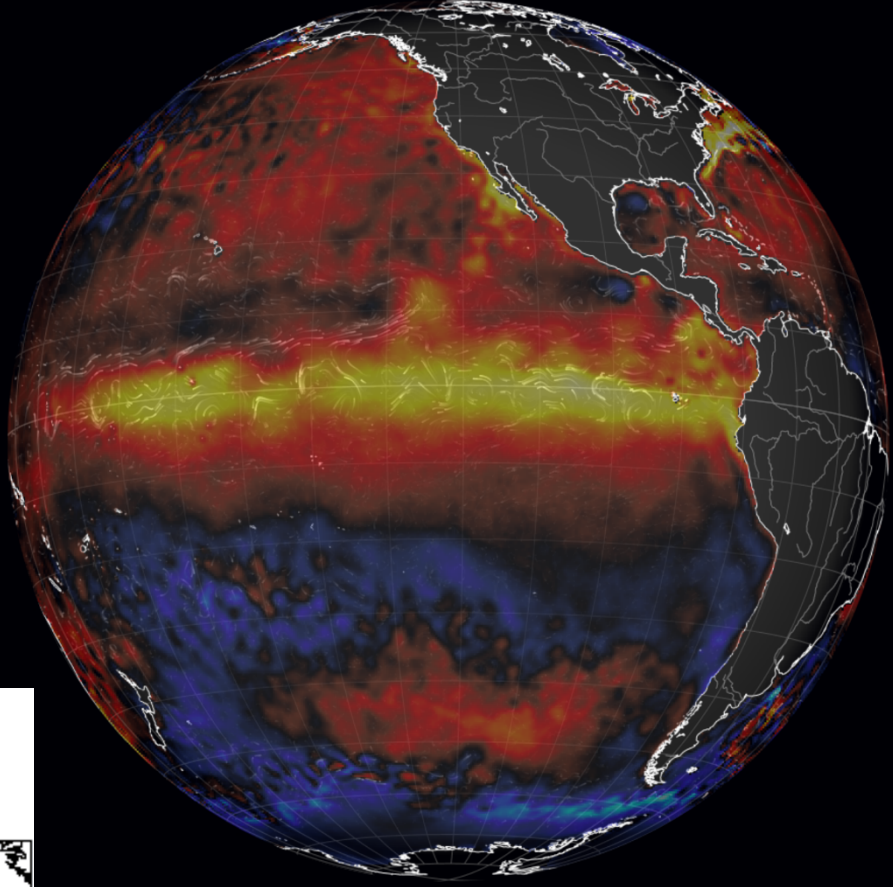




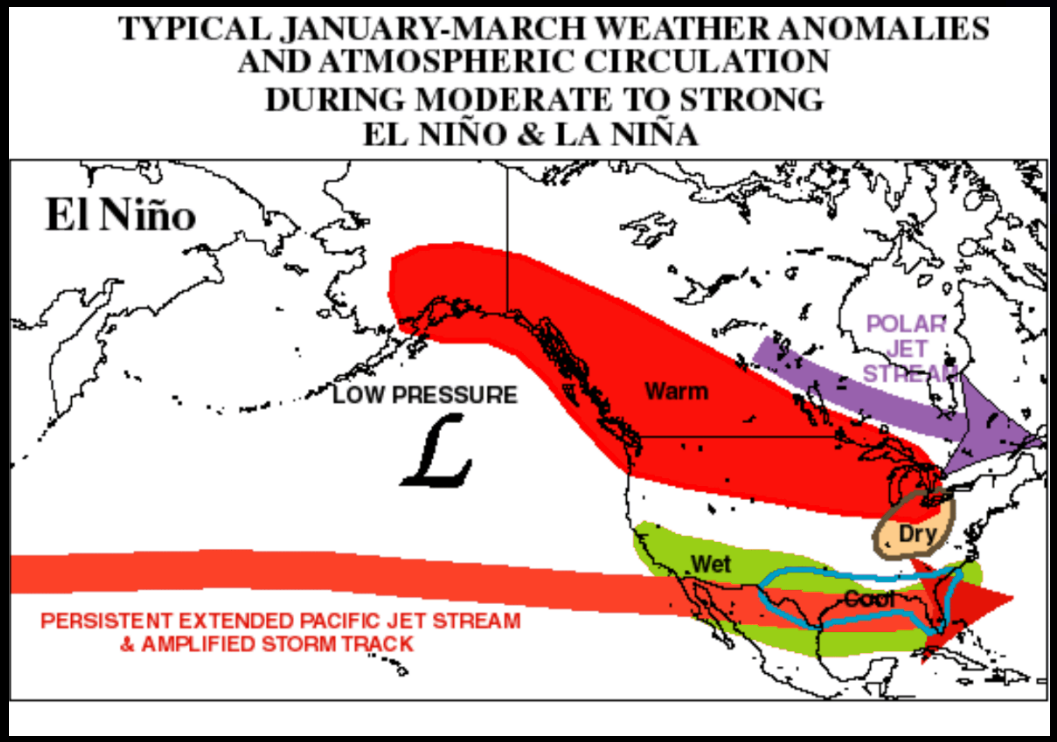




El Niño 2015-2016

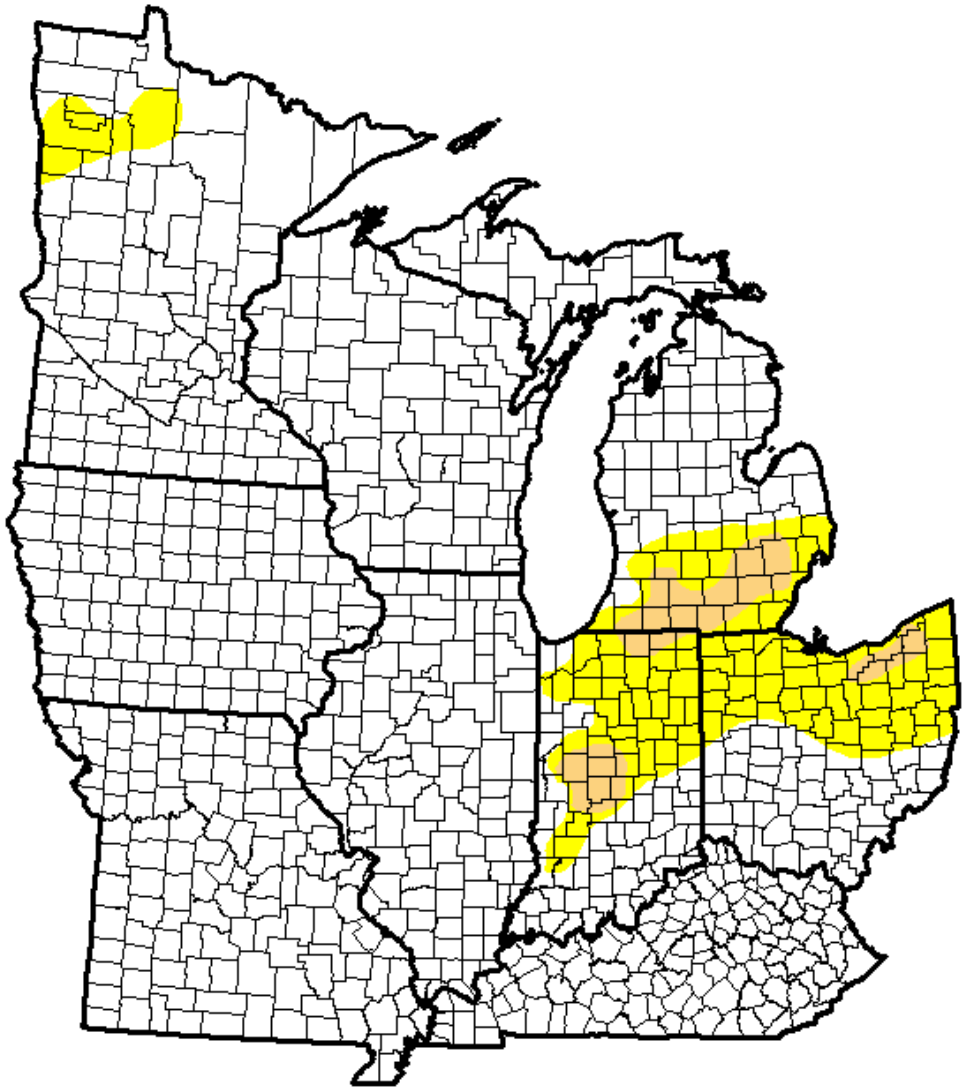


http://earth.nullschool.net



U.S. Drought Monitor

Midwest



December 29, 2015

(Released Thursday, Dec. 31, 2015)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	88.07	11.93	2.35	0.00	0.00	0.00
Last Week 12/22/2015	87.40	12.60	2.66	0.00	0.00	0.00
3 Months Ago 9/29/2015	79.46	20.54	1.04	0.00	0.00	0.00
Start of Calendar Year 12/30/2014	83.08	16.92	0.11	0.00	0.00	0.00
Start of Water Year 9/29/2015	79.46	20.54	1.04	0.00	0.00	0.00
One Year Ago 12/30/2014	83.08	16.92	0.11	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

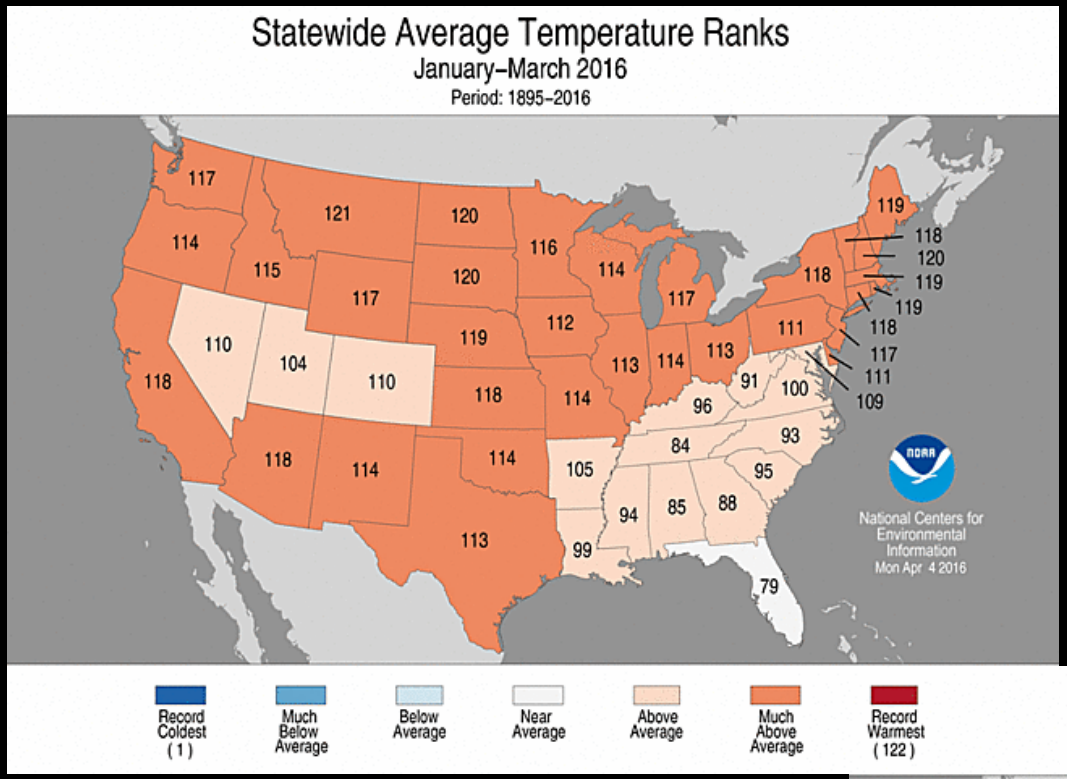
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

Chris Fenimore

NOAA/NESDIS/NCEI

http://droughtmonitor.unl.edu/

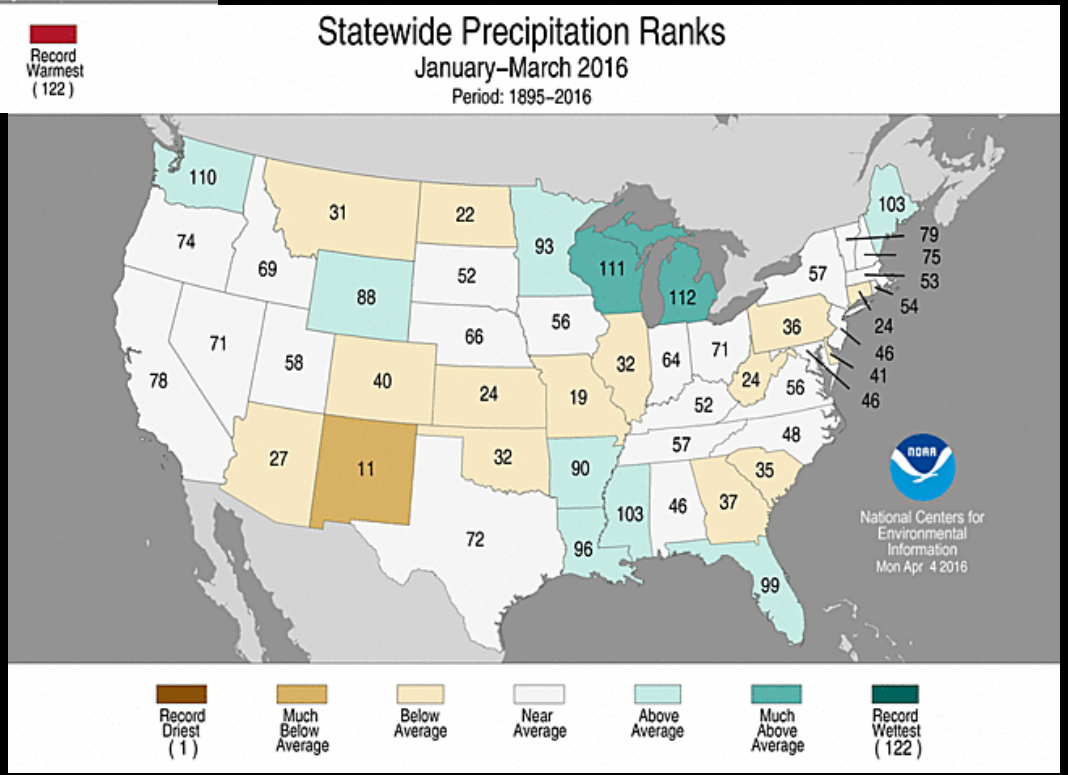


TEMPERATURE

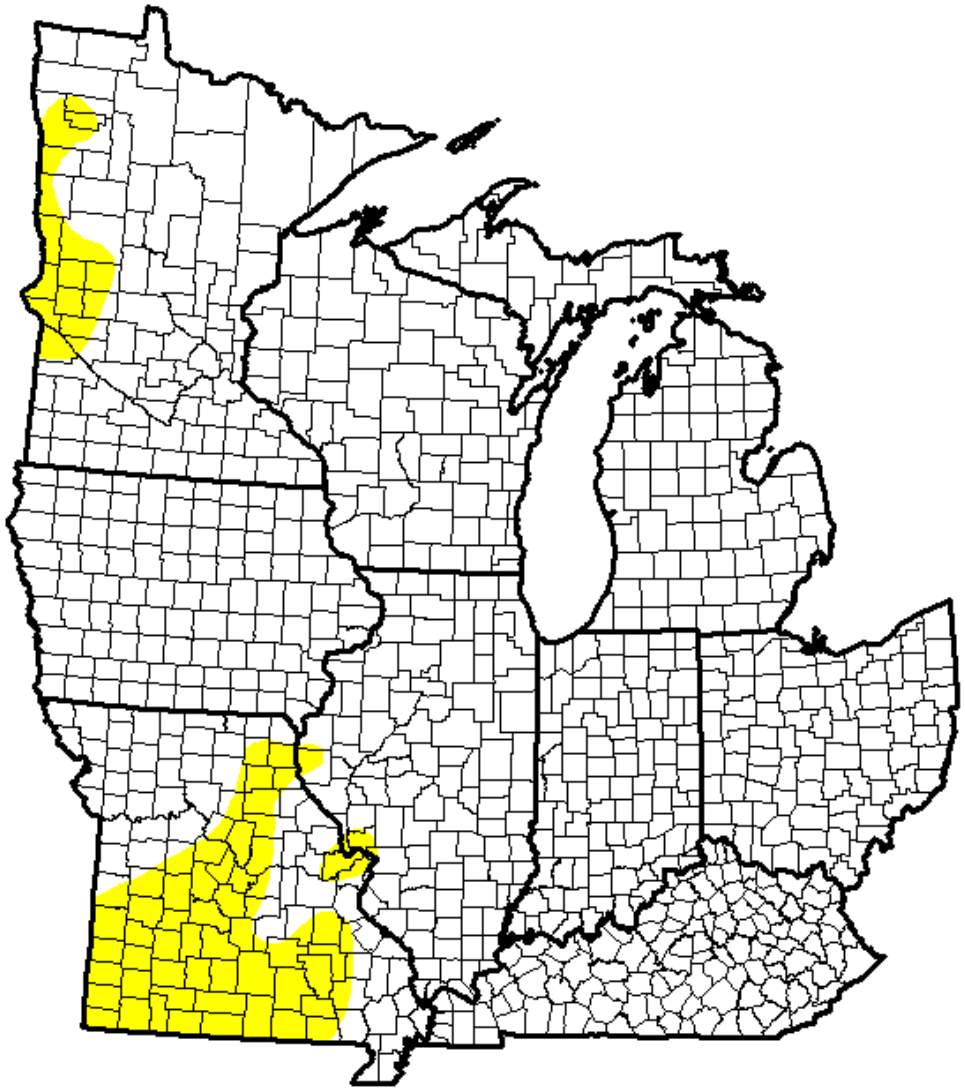
- Consistent with El Niño in KY/OH
- Cool January followed by warm Feb and Mar

PRECIPITATION

- Inconsistent with El Niño
- Dry January followed by near-average to wet Feb and Mar



U.S. Drought Monitor
Midwest



March 29, 2016

(Released Thursday, Mar. 31, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	90.77	9.23	0.00	0.00	0.00	0.00
Last Week 3/22/2016	98.11	1.89	0.00	0.00	0.00	0.00
3 Months Ago 12/29/2015	88.07	11.93	2.35	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	88.07	11.93	2.35	0.00	0.00	0.00
Start of Water Year 9/29/2015	79.46	20.54	1.04	0.00	0.00	0.00
One Year Ago 3/31/2015	54.11	45.89	21.85	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

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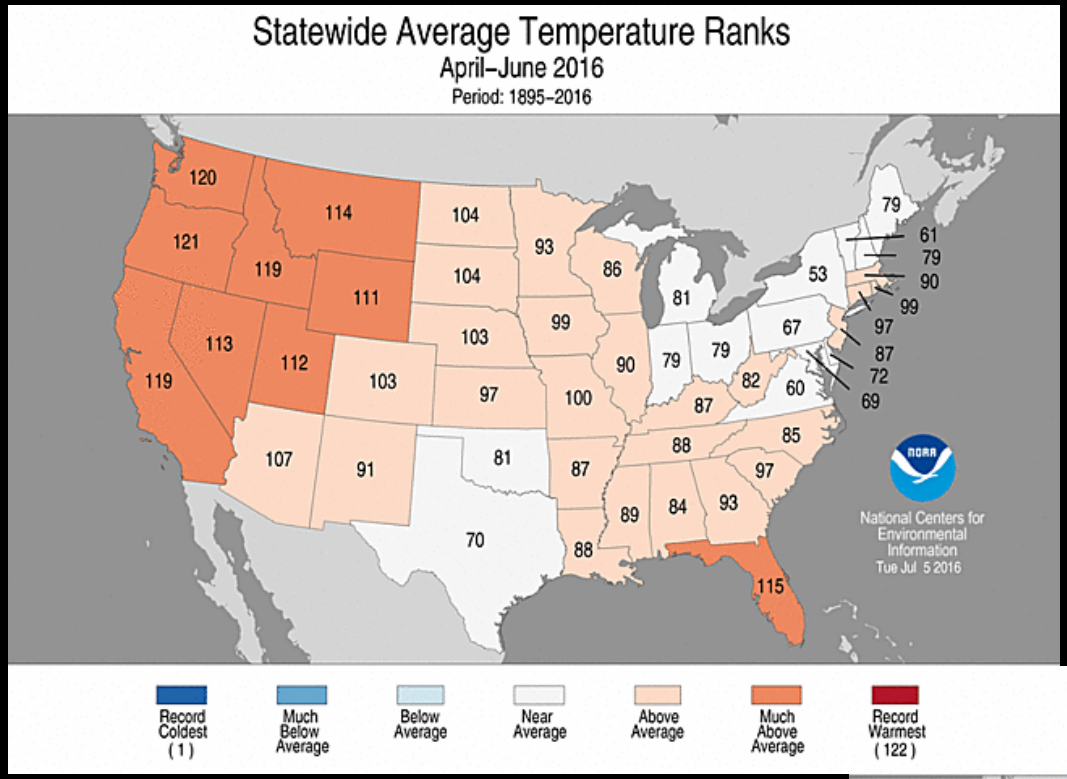
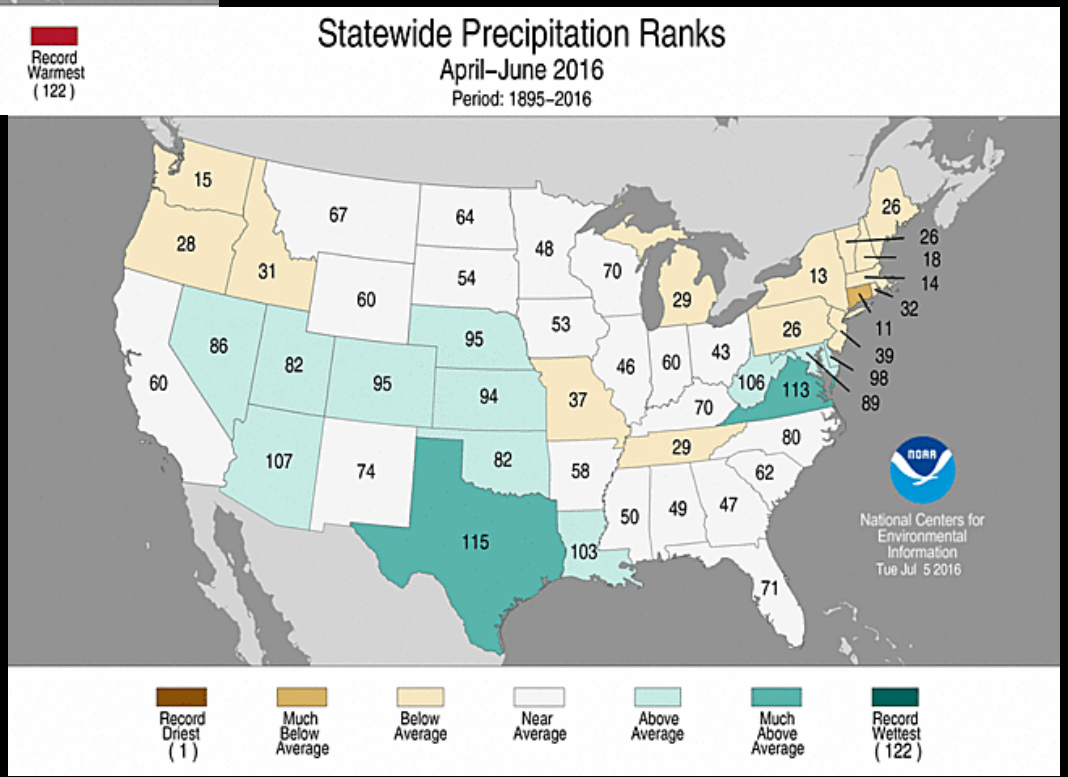
Author:
Brad Rippey
U.S. Department of Agriculture

http://droughtmonitor.unl.edu/



TEMPERATURE

- Highly variable during early spring
- Anomalously warm by June

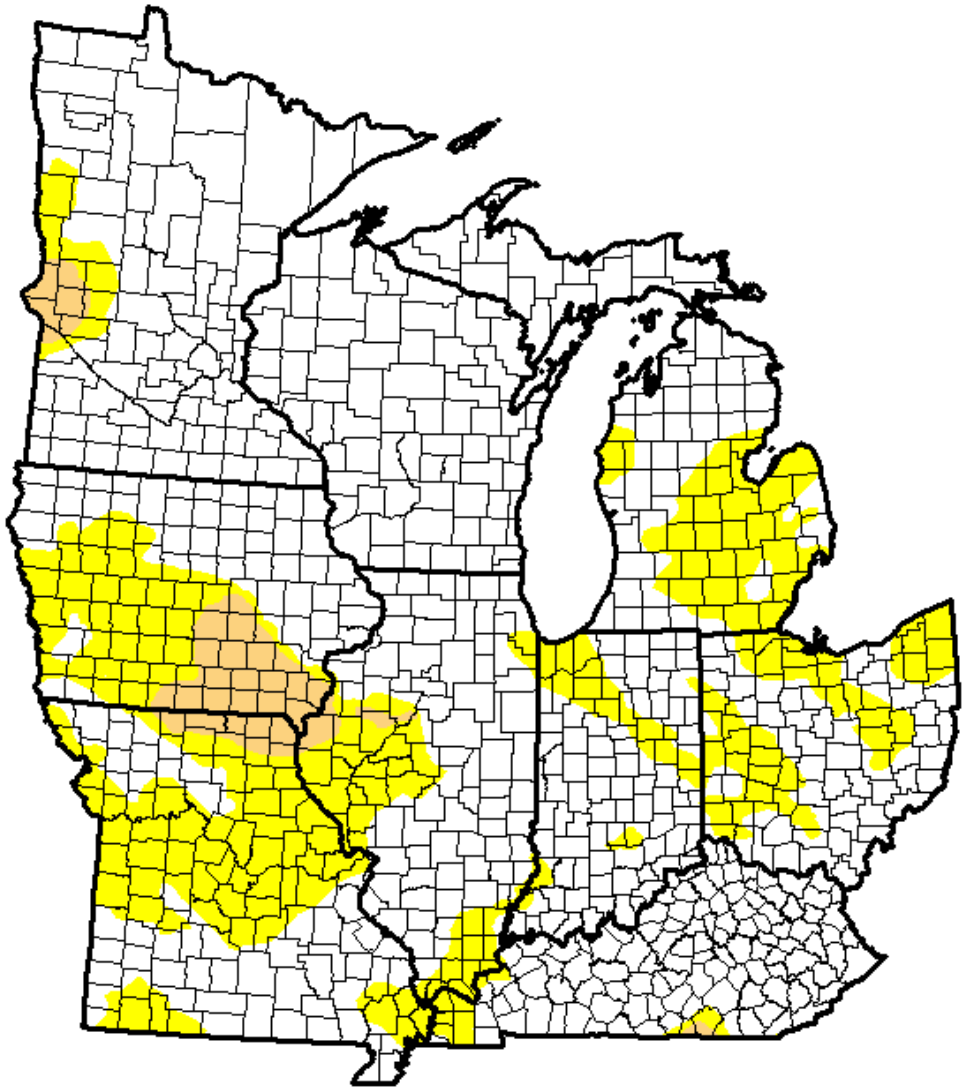


PRECIPITATION

- Highly Variable
- Dry conditions beginning to take shape in Ohio by June

U.S. Drought Monitor

Midwest



June 28, 2016

(Released Thursday, Jun. 30, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	73.04	26.96	3.40	0.00	0.00	0.00
Last Week 6/21/2016	70.40	29.60	2.02	0.00	0.00	0.00
3 Months Ago 3/29/2016	90.77	9.23	0.00	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	88.07	11.93	2.35	0.00	0.00	0.00
Start of Water Year 9/29/2015	79.46	20.54	1.04	0.00	0.00	0.00
One Year Ago 6/30/2015	95.73	4.27	0.00	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

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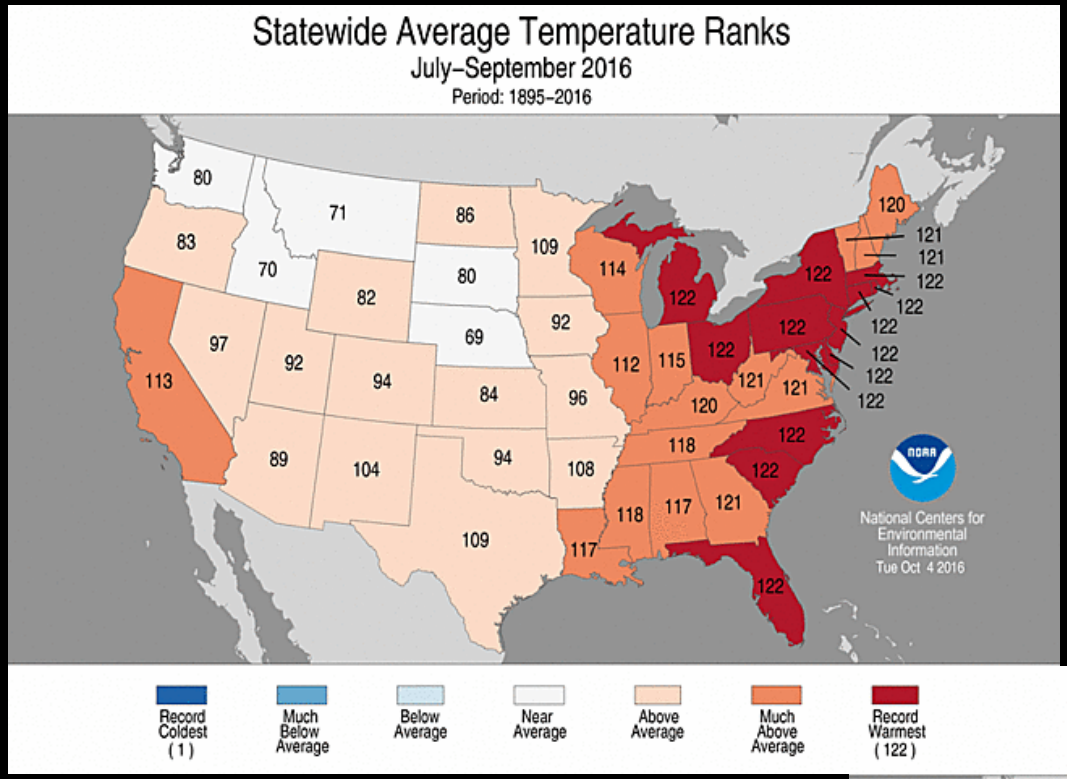
Author:

Eric Luebehusen

U.S. Department of Agriculture

http://droughtmonitor.unl.edu/



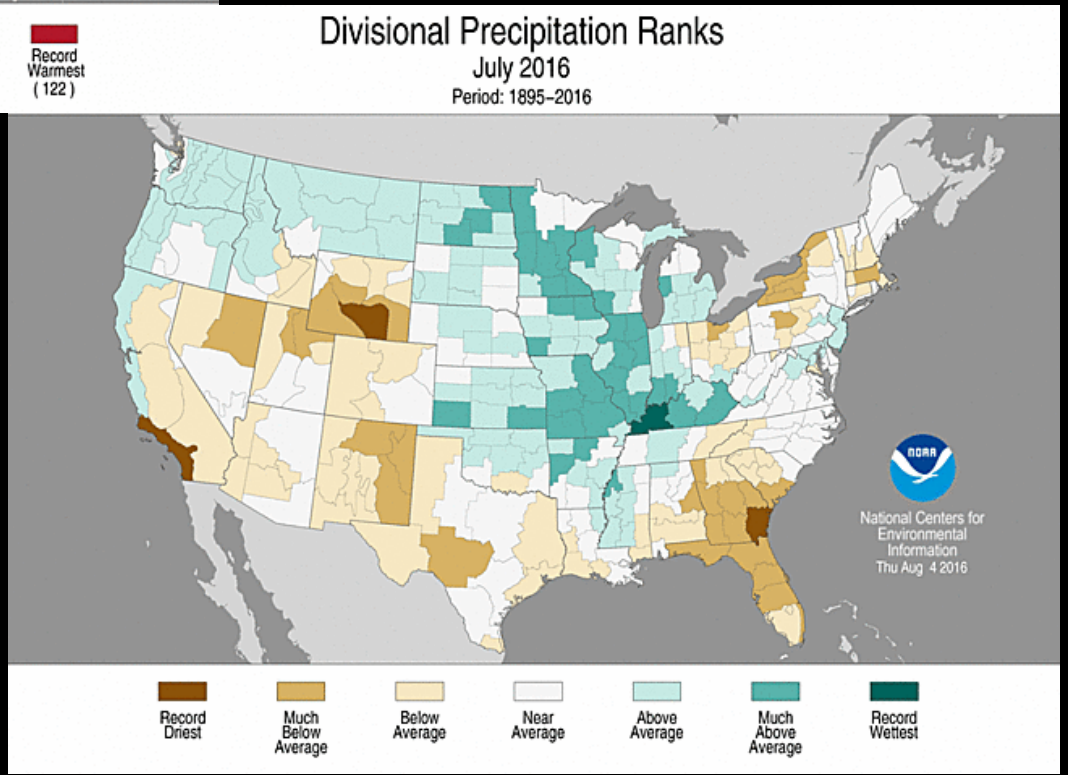
TEMPERATURE

- Near/Record Warmth
- Very warm overnight lows in the region/eastern US

PRECIPITATION

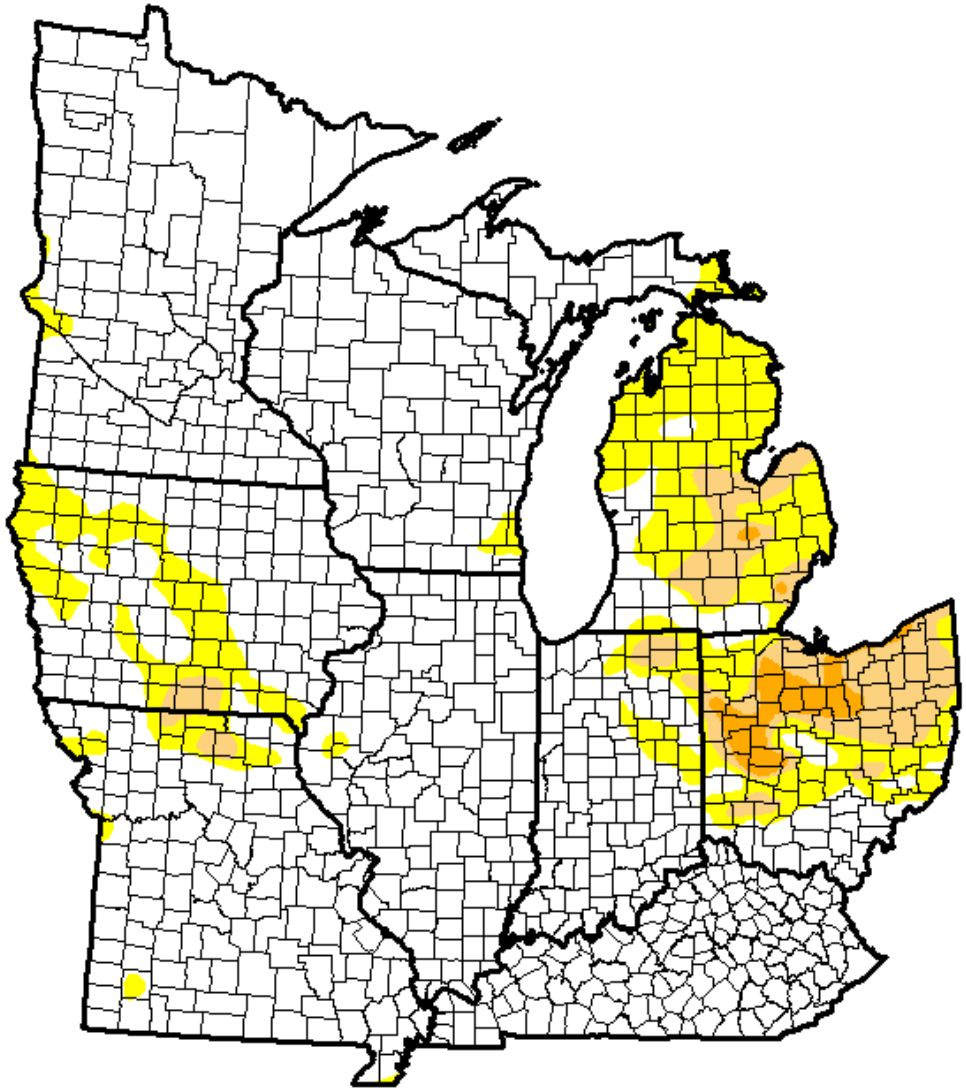
- Very dry July/early August in Ohio

	Rain	Departure from Normal
Bowling Green	11.09”	+7.02”
Frankfort	7.61”	+3.22”
Lexington	4.98”	+0.33”
Louisville	4.73”	+0.56”
Bowman		
Louisville		



U.S. Drought Monitor

Midwest



August 9, 2016

(Released Thursday, Aug. 11, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	80.70	19.30	6.08	1.26	0.00	0.00
Last Week 8/2/2016	80.64	19.36	5.86	0.00	0.00	0.00
3 Months Ago 5/10/2016	89.24	10.76	1.15	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	88.07	11.93	2.35	0.00	0.00	0.00
Start of Water Year 9/29/2015	79.46	20.54	1.04	0.00	0.00	0.00
One Year Ago 8/11/2015	93.15	6.85	0.73	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

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Author:

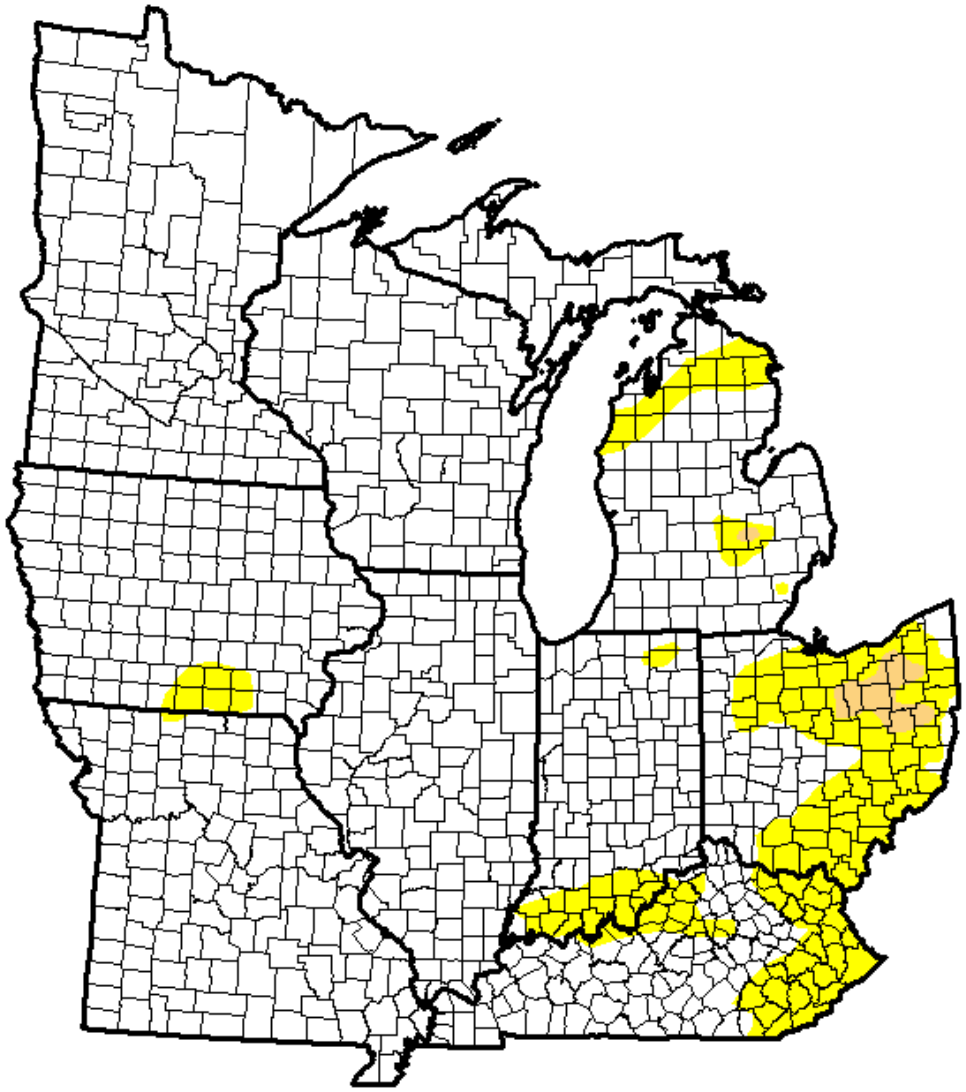
Richard Tinker

CPC/NOAA/NWS/NCEP

http://droughtmonitor.unl.edu/

U.S. Drought Monitor

Midwest



September 27, 2016

(Released Thursday, Sep. 29, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	89.04	10.96	0.70	0.00	0.00	0.00
Last Week 9/20/2016	93.78	6.22	1.46	0.00	0.00	0.00
3 Months Ago 6/28/2016	73.04	26.96	3.40	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	88.07	11.93	2.35	0.00	0.00	0.00
Start of Water Year 9/29/2015	79.46	20.54	1.04	0.00	0.00	0.00
One Year Ago 9/29/2015	79.46	20.54	1.04	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
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NCEI/NESDIS/NOAA

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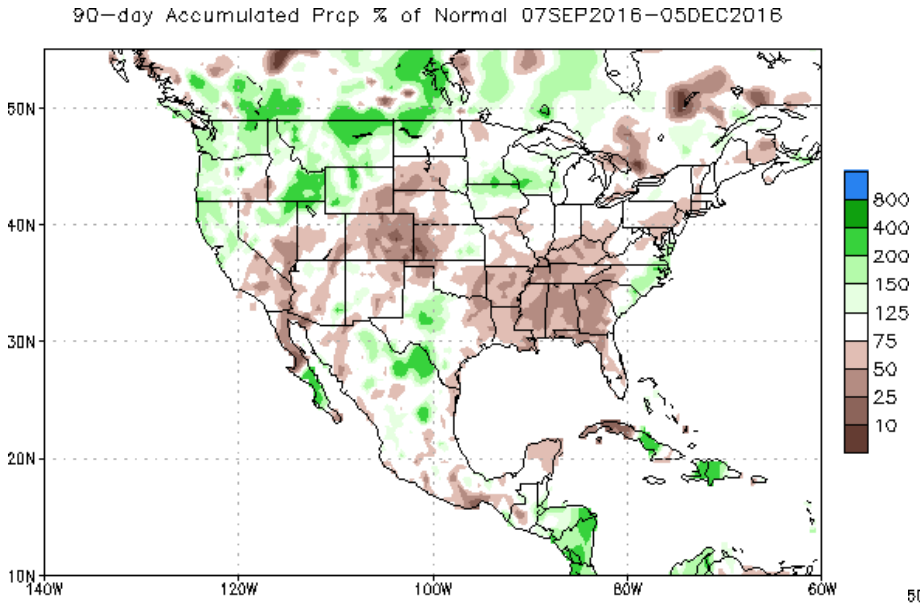
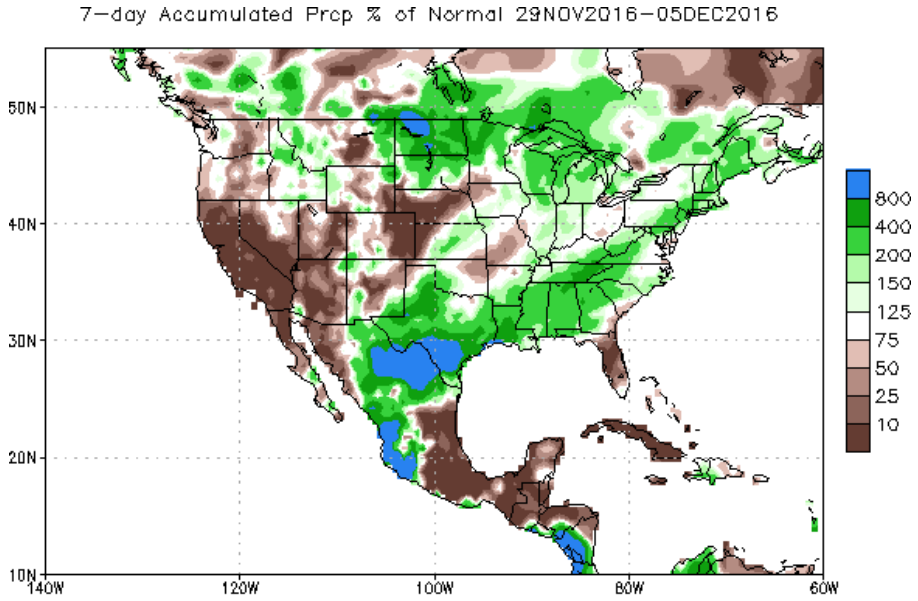
90-Day Precipitation Anomalies



Data Source: CPC Unified (gauge-based & 0.5x0.5 deg resolution) Precipitation Analysis Climatology (1981-2010)



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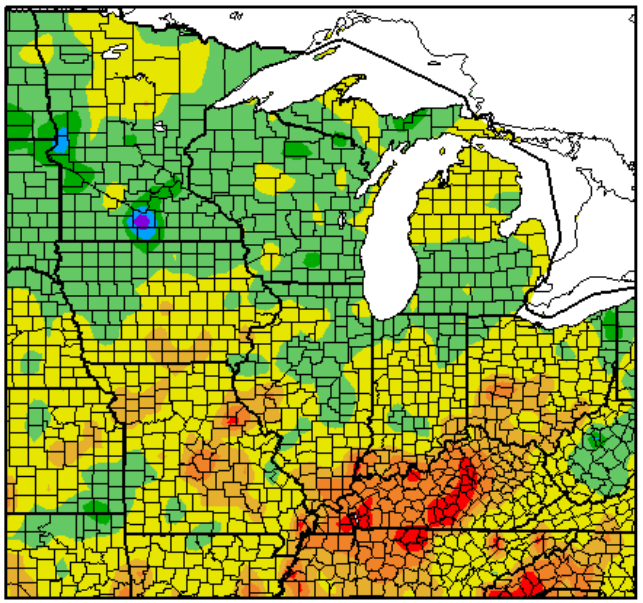
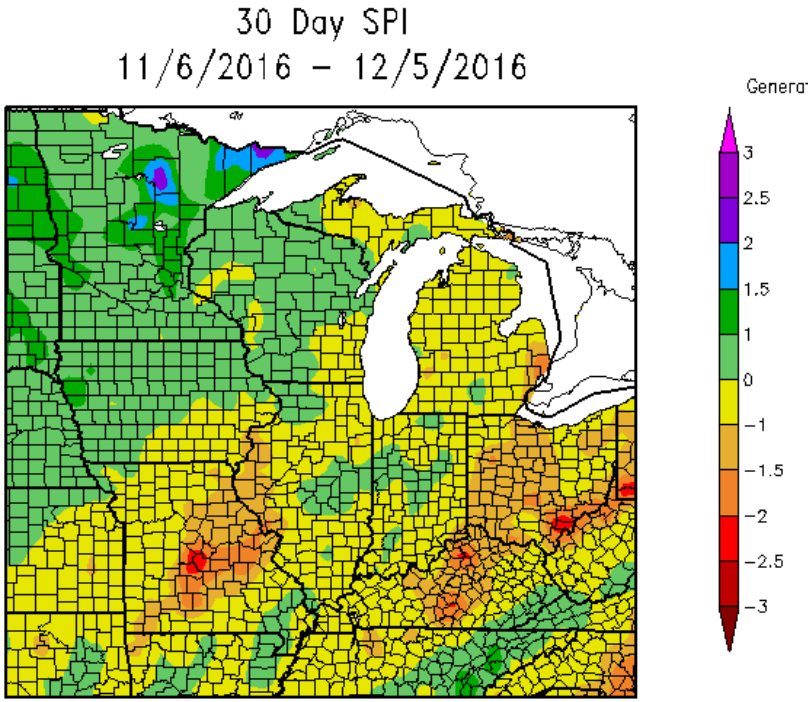
30/60-Day* Drought Indicators



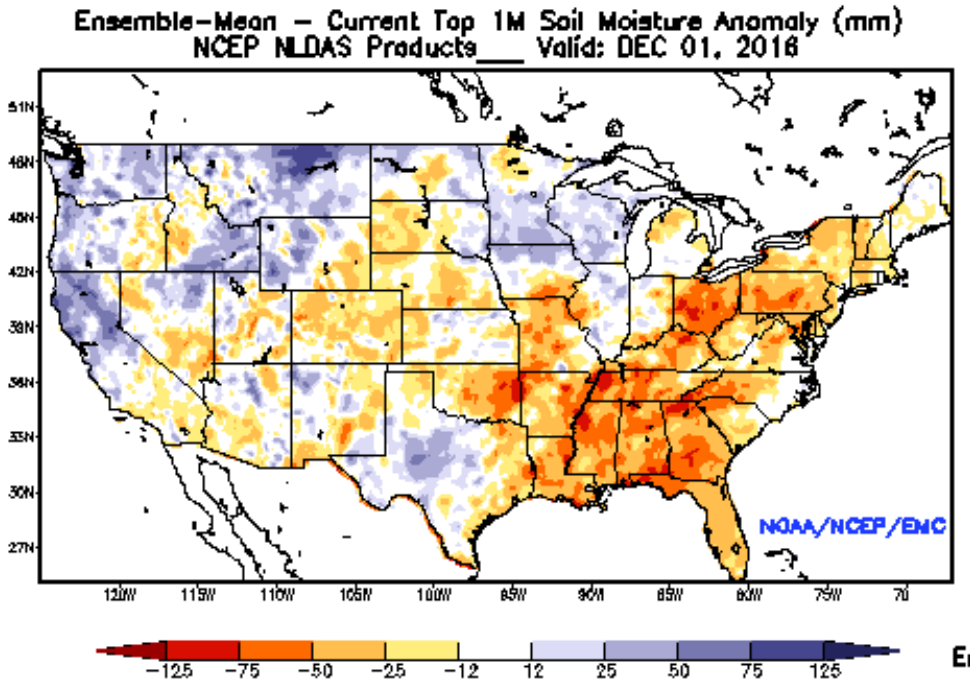


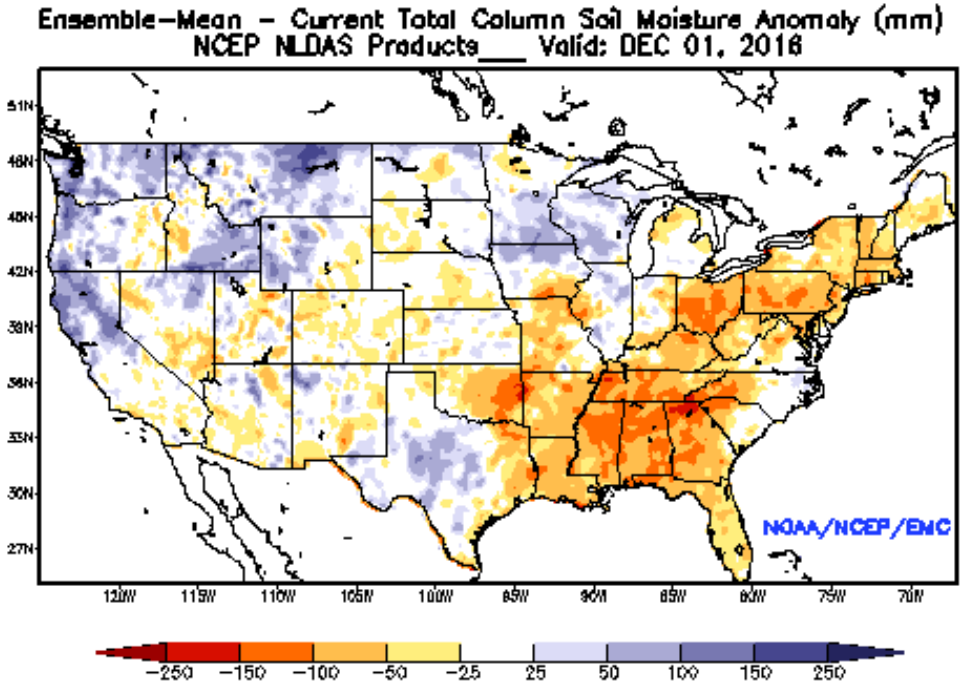
NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

NIDIS Drought.gov U.S. Drought Portal

*WxCoder system – Missing Data

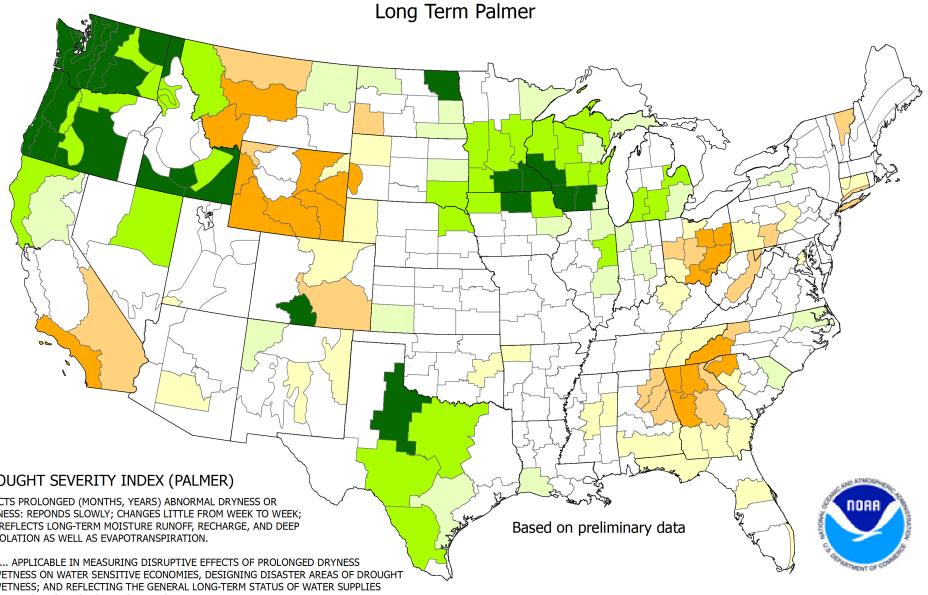
Soil Moisture





PDSI

Drought Severity Index by Division
Weekly Value for Period Ending Dec 03, 2016
Long Term Palmer



DROUGHT SEVERITY INDEX (PALMER)

DEPICTS PROLONGED (MONTHS, YEARS) ABNORMAL DRYNESS OR WETNESS: REPONDS SLOWLY; CHANGES LITTLE FROM WEEK TO WEEK; AND REFLECTS LONG-TERM MOISTURE RUNOFF, RECHARGE, AND DEEP PERCOLATION AS WELL AS EVAPOTRANSPIRATION.

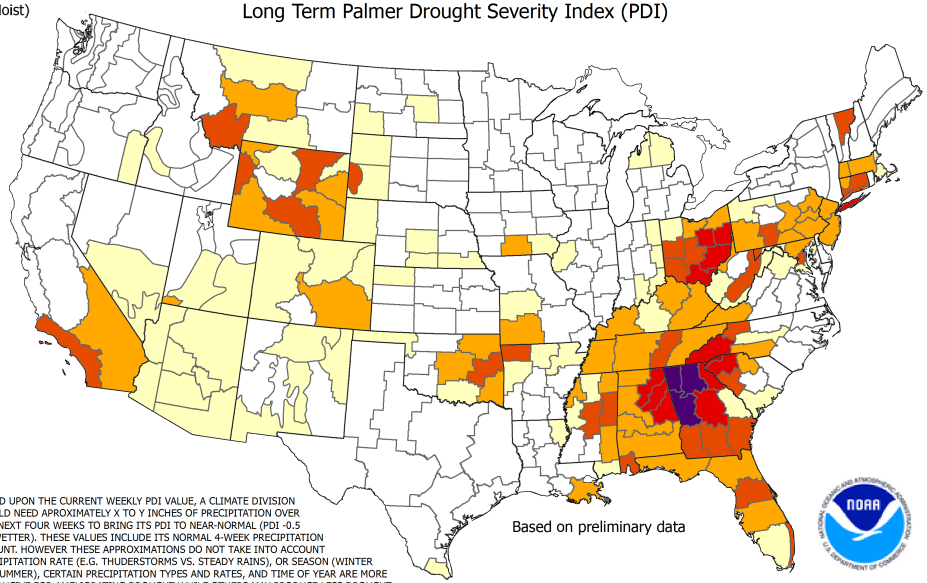
USES... APPLICABLE IN MEASURING DISRUPTIVE EFFECTS OF PROLONGED DRYNESS OR WETNESS ON WATER SENSITIVE ECONOMIES, DESIGNING DISASTER AREAS OF DROUGHT OR WETNESS; AND REFLECTING THE GENERAL LONG-TERM STATUS OF WATER SUPPLIES IN AQUIFERS, RESERVOIRS AND STREAMS.

LIMITATIONS... IS NOT GENERALLY INDICATIVE OFFSHORT-TERM (FEW WEEKS) STATUS OF DROUGHT OR WETNESS SUCH AS FREQUENTLY AFFECTS CROPS AND FIELD OPERATIONS (THIS IS INDICATED BY THE CROP MOISTURE INDEX).

Based on preliminary data

-4.0 or less (Extreme Drought)
-3.0 to -3.9 (Severe Drought)
-2.0 to -2.9 (Moderate Drought)
--1.9 to +1.9 (Near Normal)
+2.0 to +2.9 (Unusual Moist Spell)
+3.0 to +3.9 (Very Moist Spell)
+4.0 and above (Extremely Moist)

Additional Precip. Needed (In.) to bring PDI to -0.5
Weekly Value for Period Ending Dec 03, 2016
Long Term Palmer Drought Severity Index (PDI)



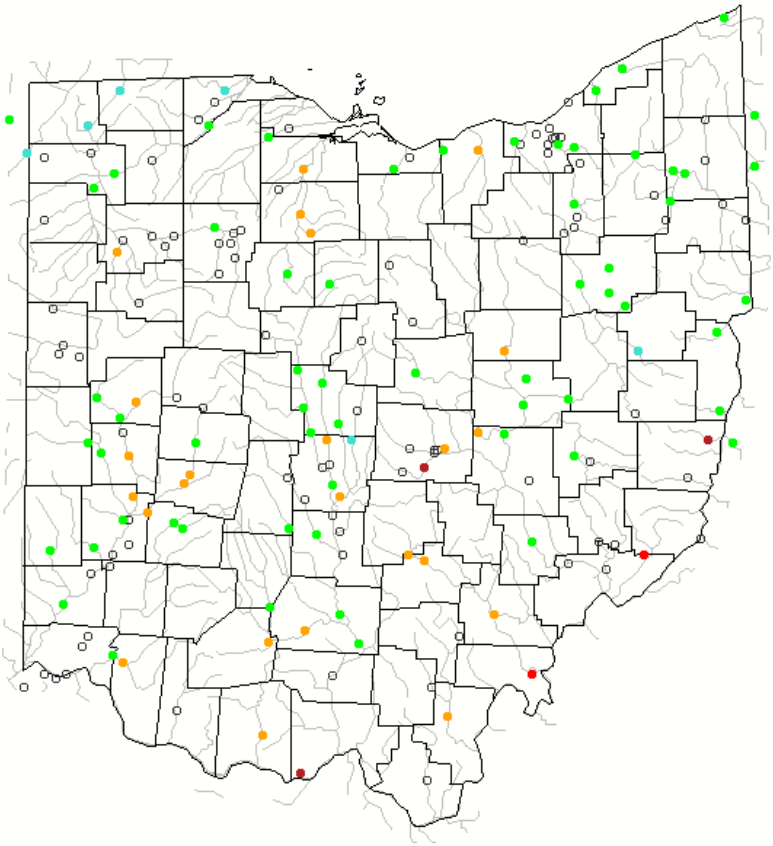
BASED UPON THE CURRENT WEEKLY PDI VALUE, A CLIMATE DIVISION WOULD NEED APROXIMATELY X TO Y INCHES OF PRECIPITATION OVER THE NEXT FOUR WEEKS TO BRING ITS PDI TO NEAR-NORMAL (PDI -0.5 OR WETTER). THESE VALUES INCLUDE ITS NORMAL 4-WEEK PRECIPITATION AMOUNT. HOWEVER THESE APPROXIMATIONS DO NOT TAKE INTO ACCOUNT PRECIPITATION RATE (E.G. THUDERSTORMS VS. STEADY RAINS), OR SEASON (WINTER VS. SUMMER), CERTAIN PRECIPITATION TYPES AND RATES, AND TIME OF YEAR ARE MORE CONDUCIVE FOR AMELIORATING DROUGHT WHILE OTHERS MAY PRODUCE LESS DROUGHT REDUCTION (E.G. RUNOFF OR FROZEN GROUND).

UNCOLORED CLIMATE DIVISIONS ARE CURRENTLY AT NEAR-NORMAL TO MOIST PDI CONDITIONS. (EXAMPLE - IF 4-WEEK NORMAL PRECIPITATION IS 3 INCHES AND PDI DEFICIT TO BRING TO -0.5 IS 4 INCHES, THE VALUE IS 7)

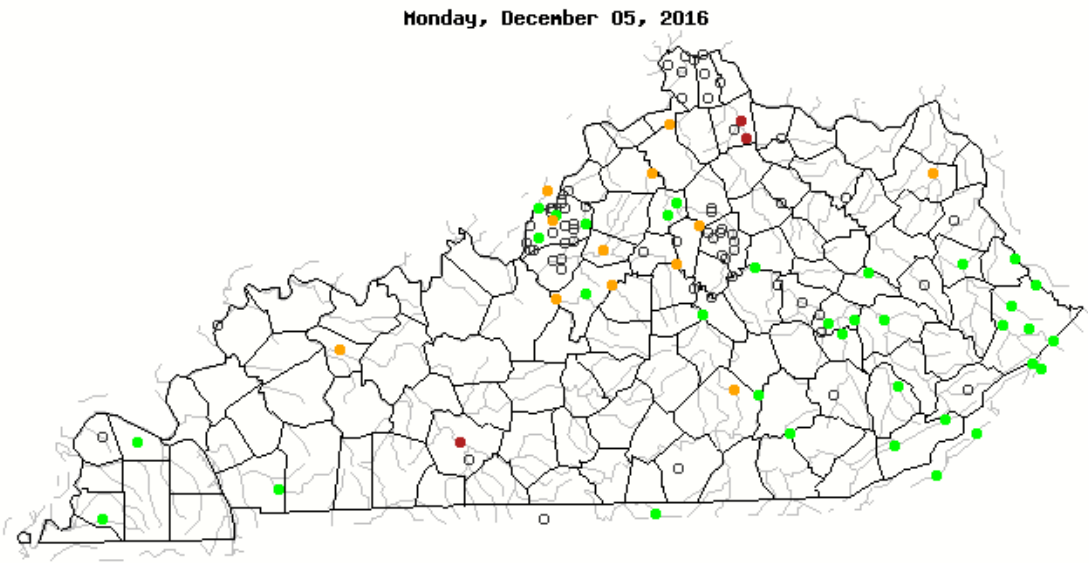
Based on preliminary data

Zero Inches
Trace to 3 Inches
3 to 6 Inches
6 to 9 Inches
9 to 12 Inches
12 to 15 Inches
Over 15 Inches

2-State USGS Stream Flow



Explanation - Percentile classes							
Low	<10 Much below normal	10-24 Below normal	25-75 Normal	76-90 Above normal	>90 Much above normal	High	Not-ranked

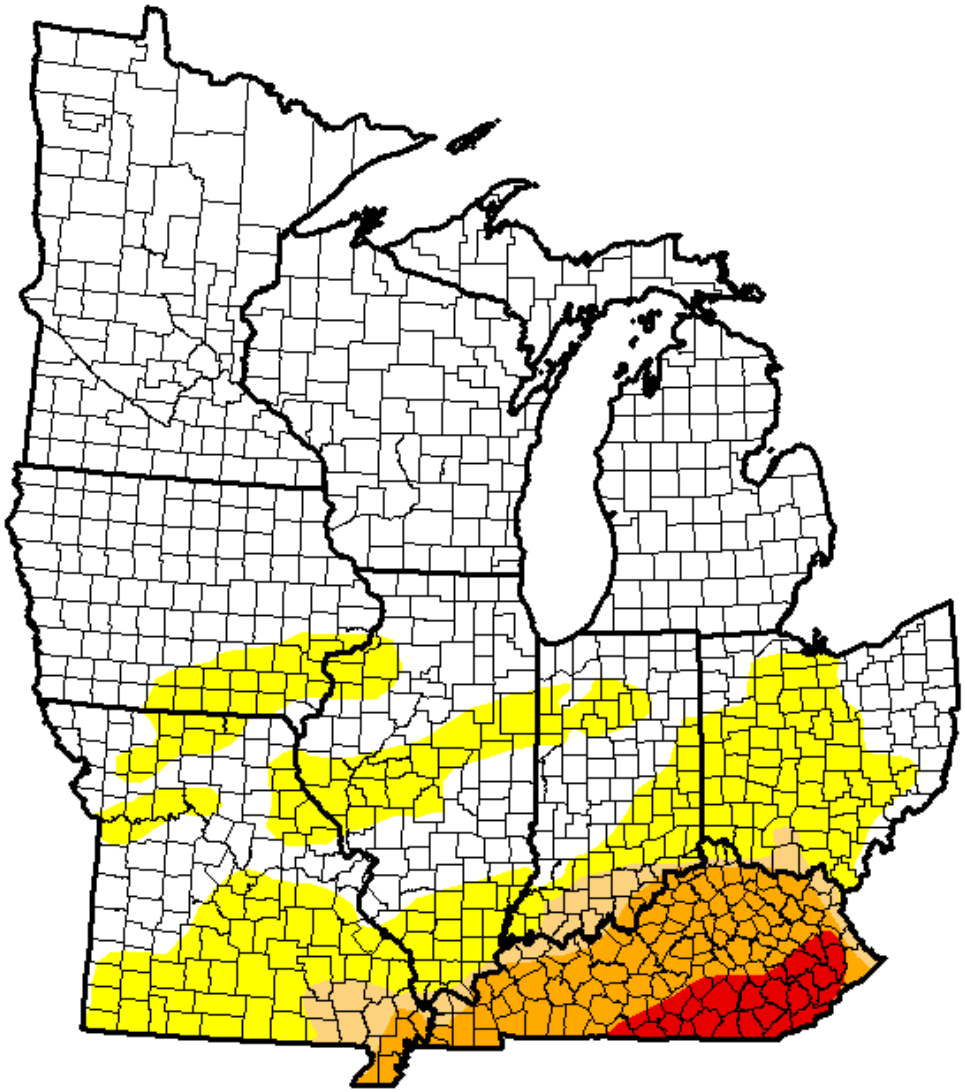


7-Day

USGS

U.S. Drought Monitor

Midwest



November 29, 2016

(Released Thursday, Dec. 1, 2016)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	68.63	31.37	10.67	7.89	2.00	0.00
Last Week *11/22/2016*	69.47	30.53	11.34	8.39	1.46	0.00
3 Months Ago *8/30/2016*	89.86	10.14	1.83	0.00	0.00	0.00
Start of Calendar Year *12/29/2015*	88.07	11.93	2.35	0.00	0.00	0.00
Start of Water Year *9/27/2016*	89.04	10.96	0.70	0.00	0.00	0.00
One Year Ago *12/1/2015*	84.74	15.26	3.16	0.00	0.00	0.00

Intensity:

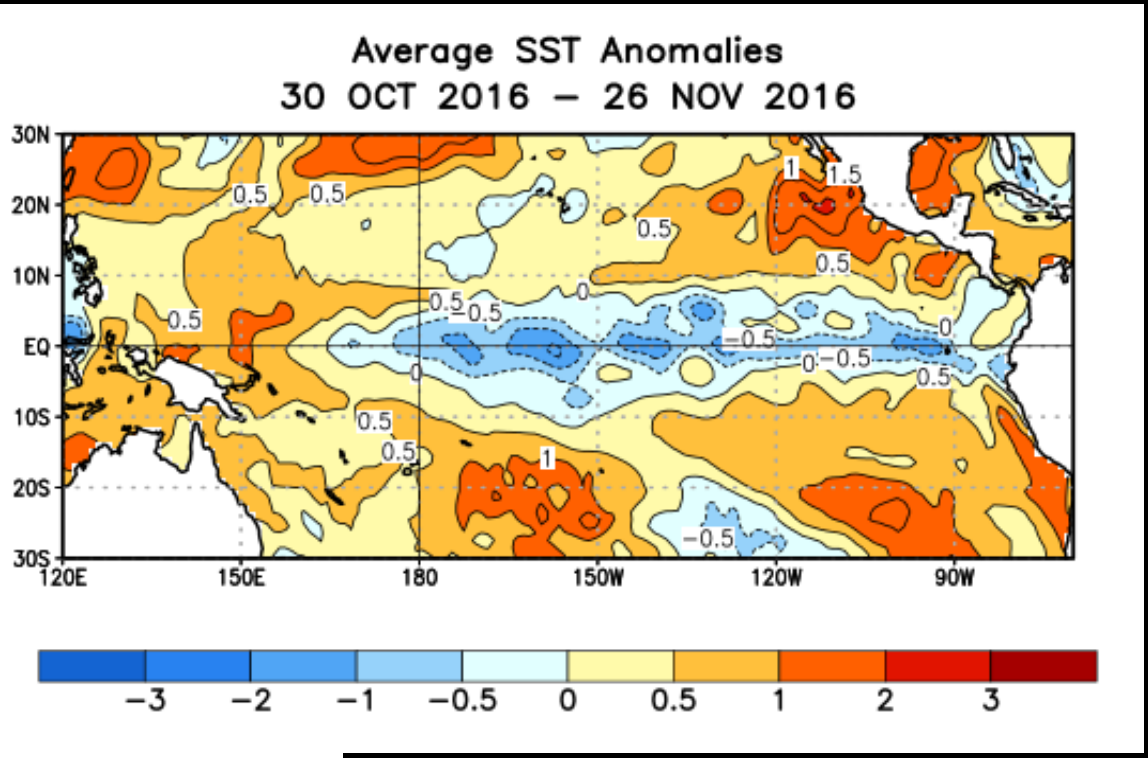
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

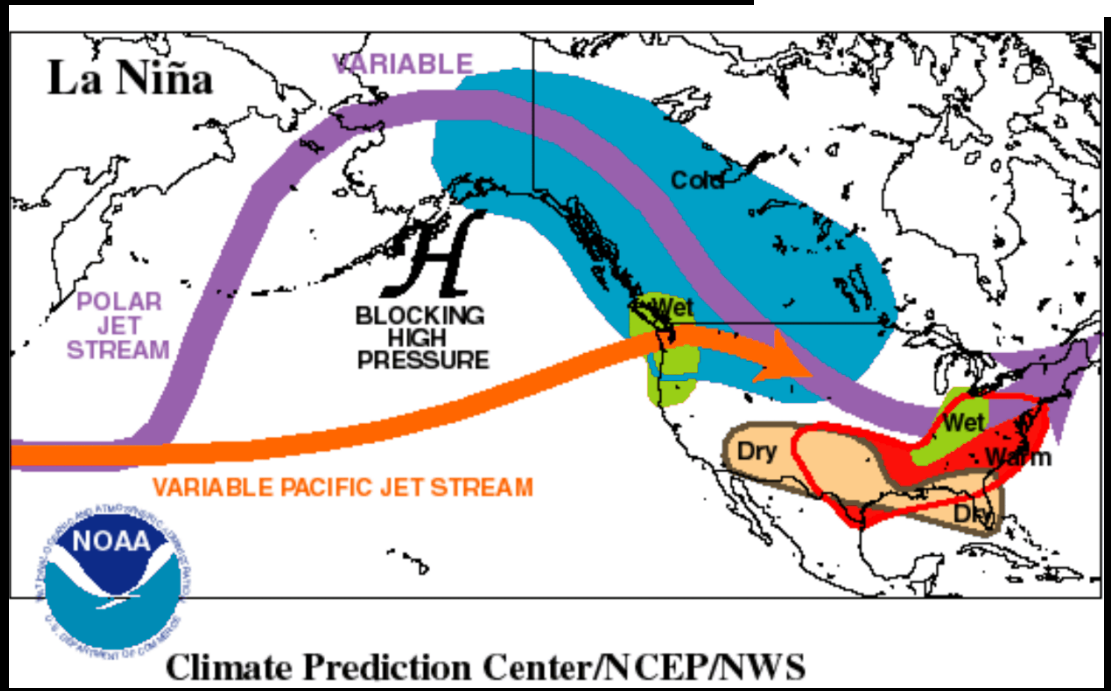
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Richard Heim
NCEI/NOAA

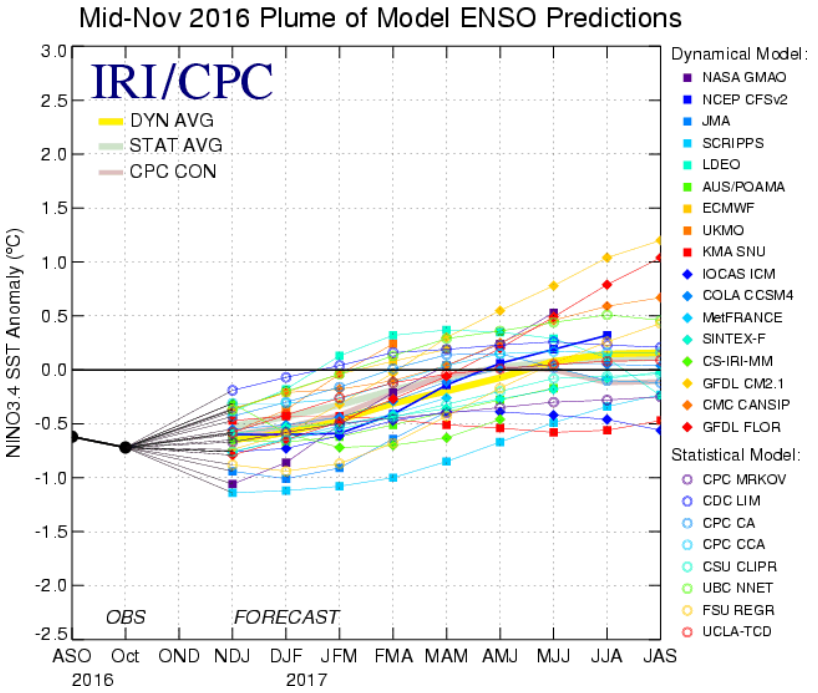
http://droughtmonitor.unl.edu/

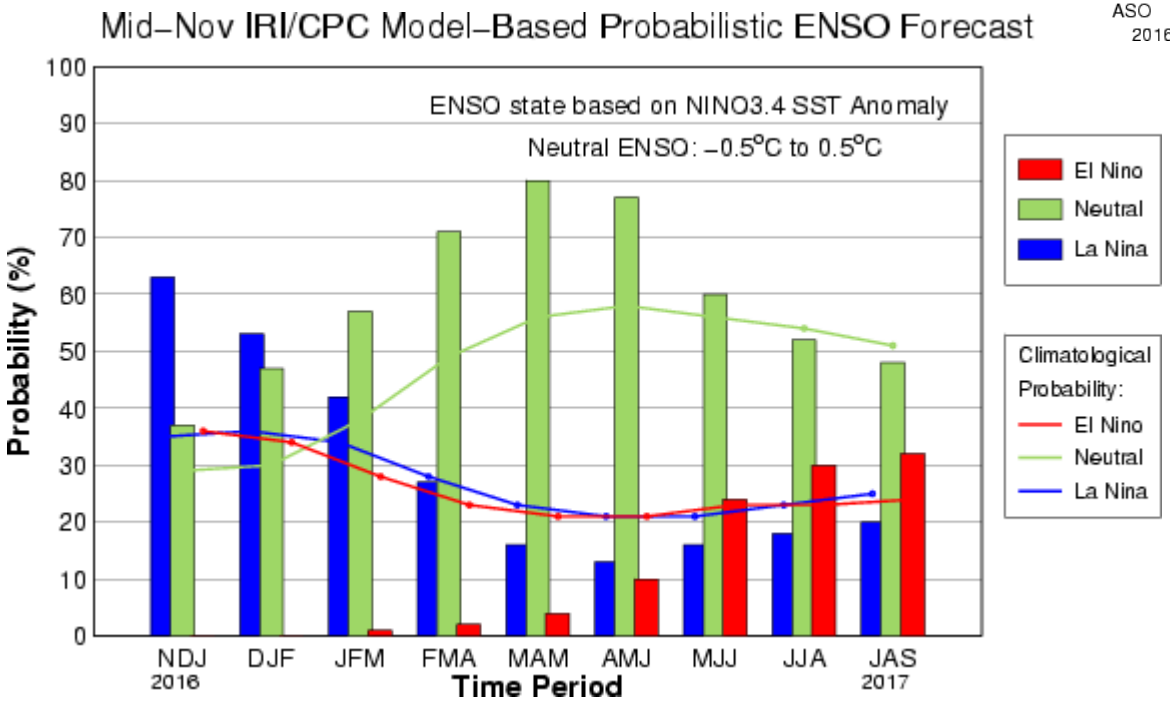
La Niña 2016-2017





ENSO Forecast





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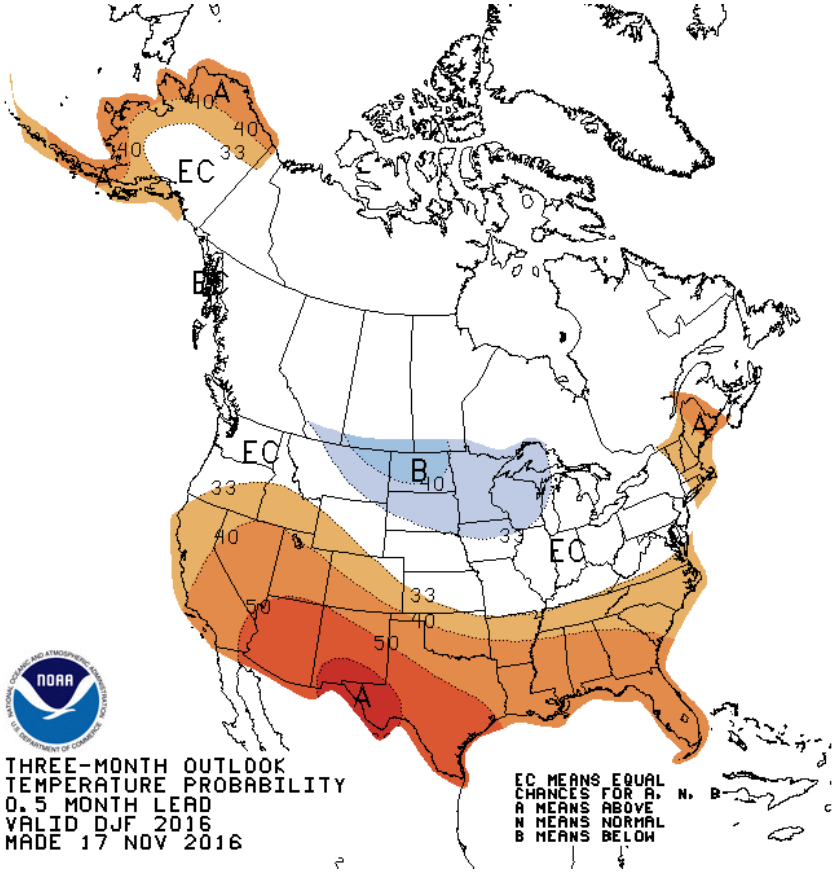
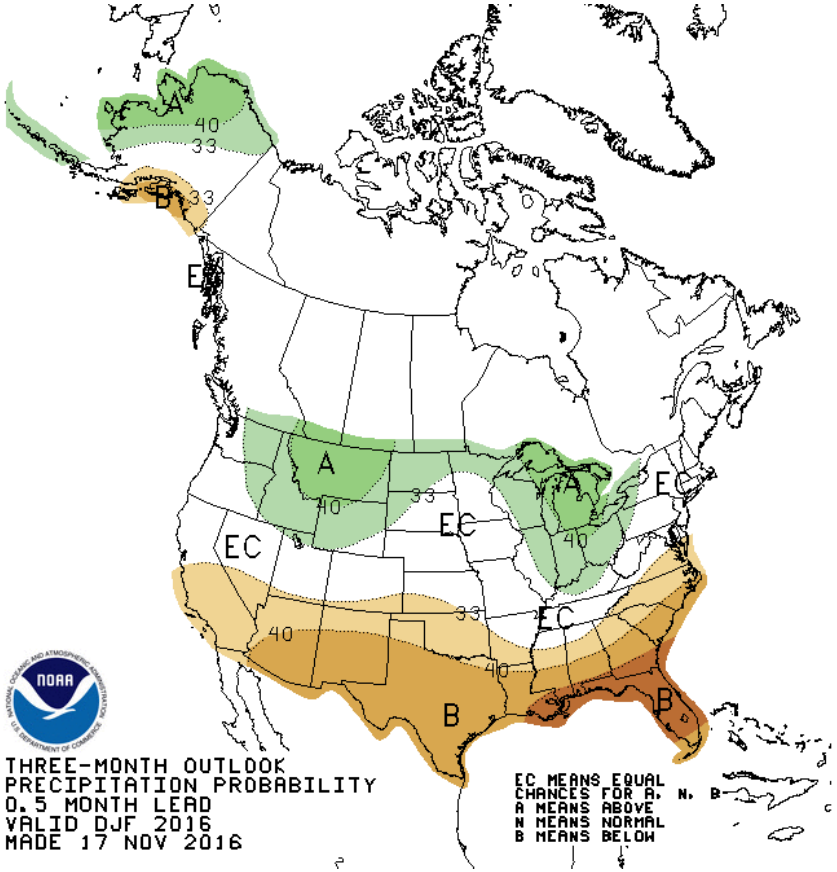
Three Month Outlook (DJF)

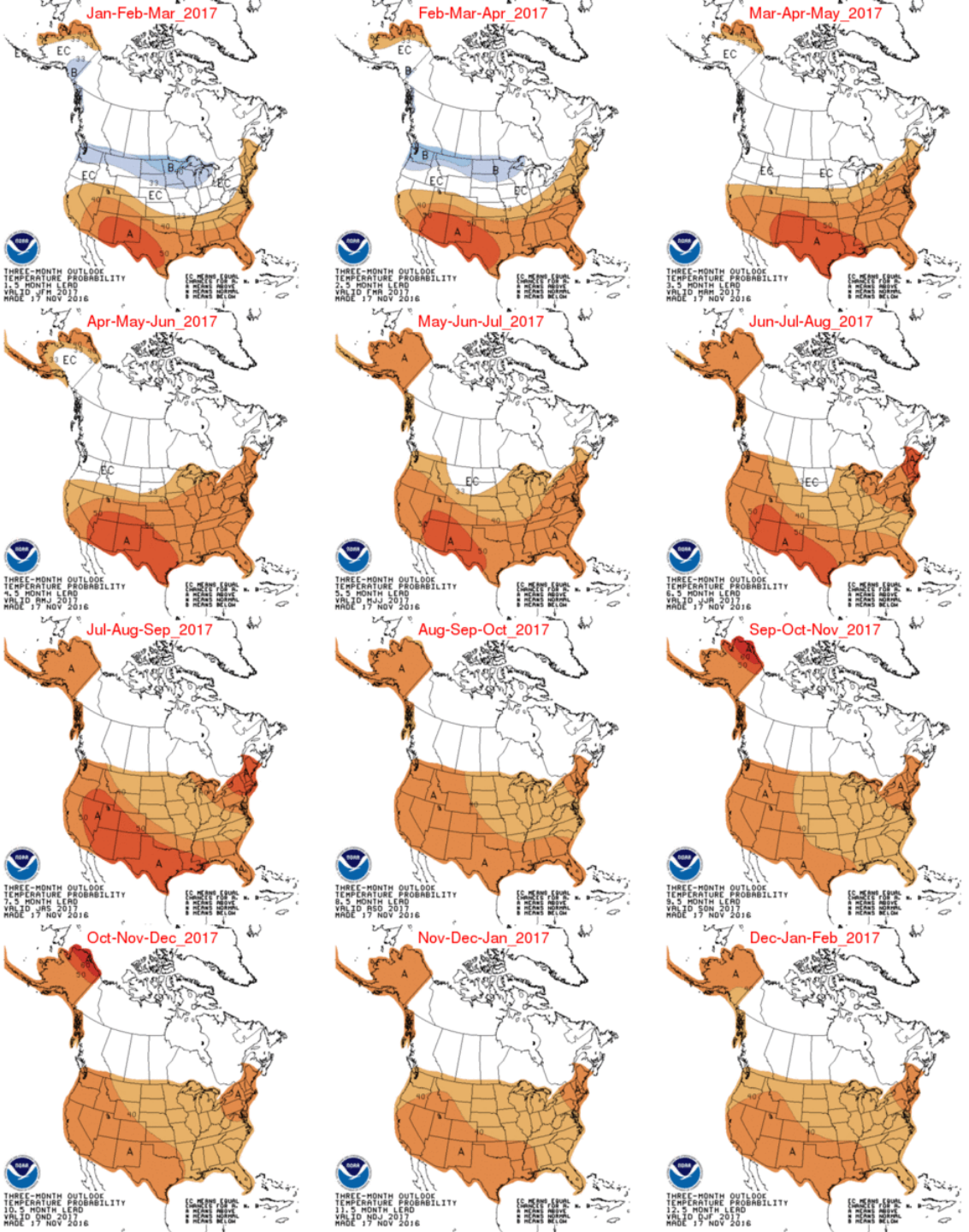




2017 Seasonal Outlooks

TEMPERATURE

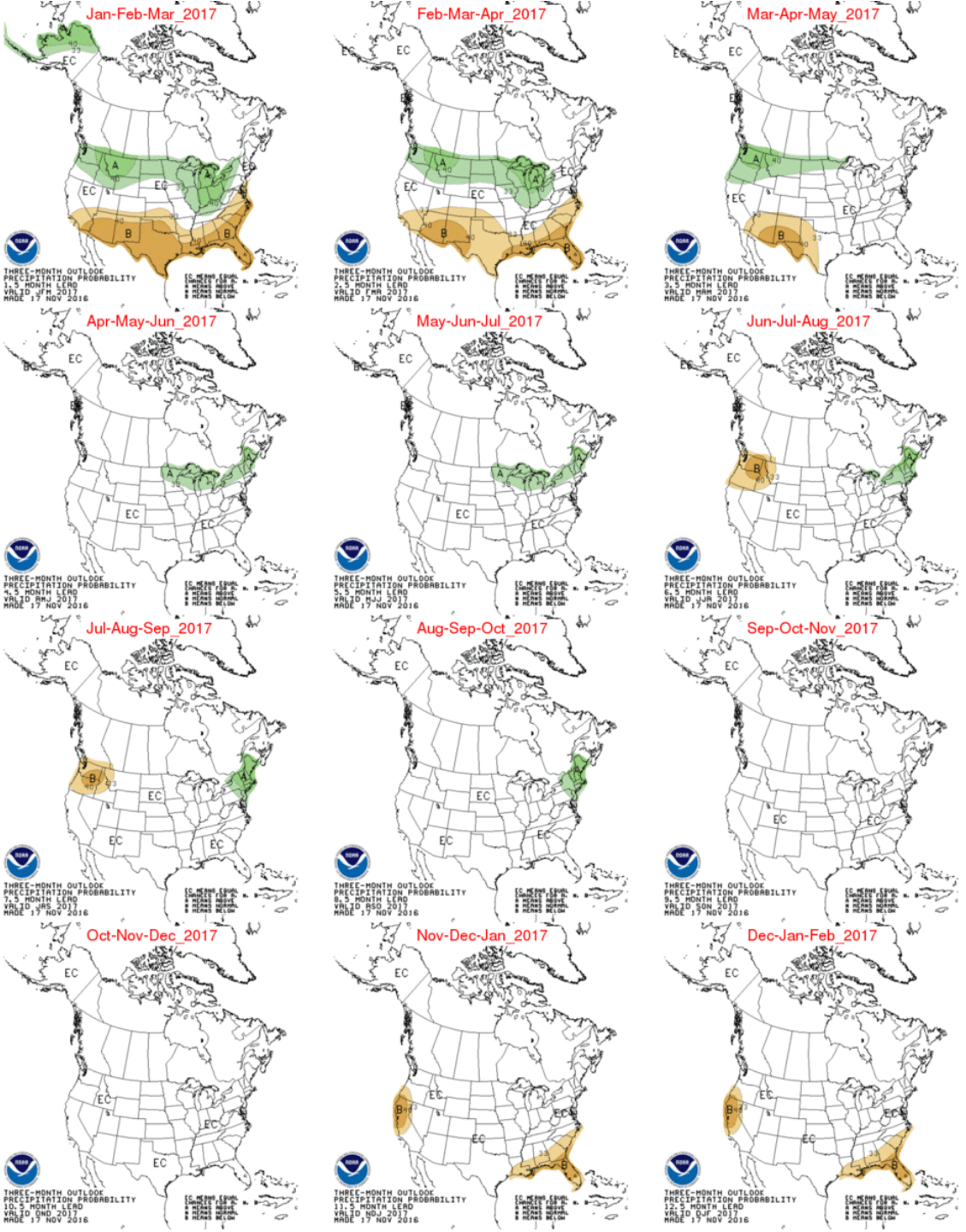
- Winter pattern holds for La Niña
- Cold Upper Midwest; Warm across the Southern States
- Long-term dominated by background warming



2017 Seasonal Outlooks

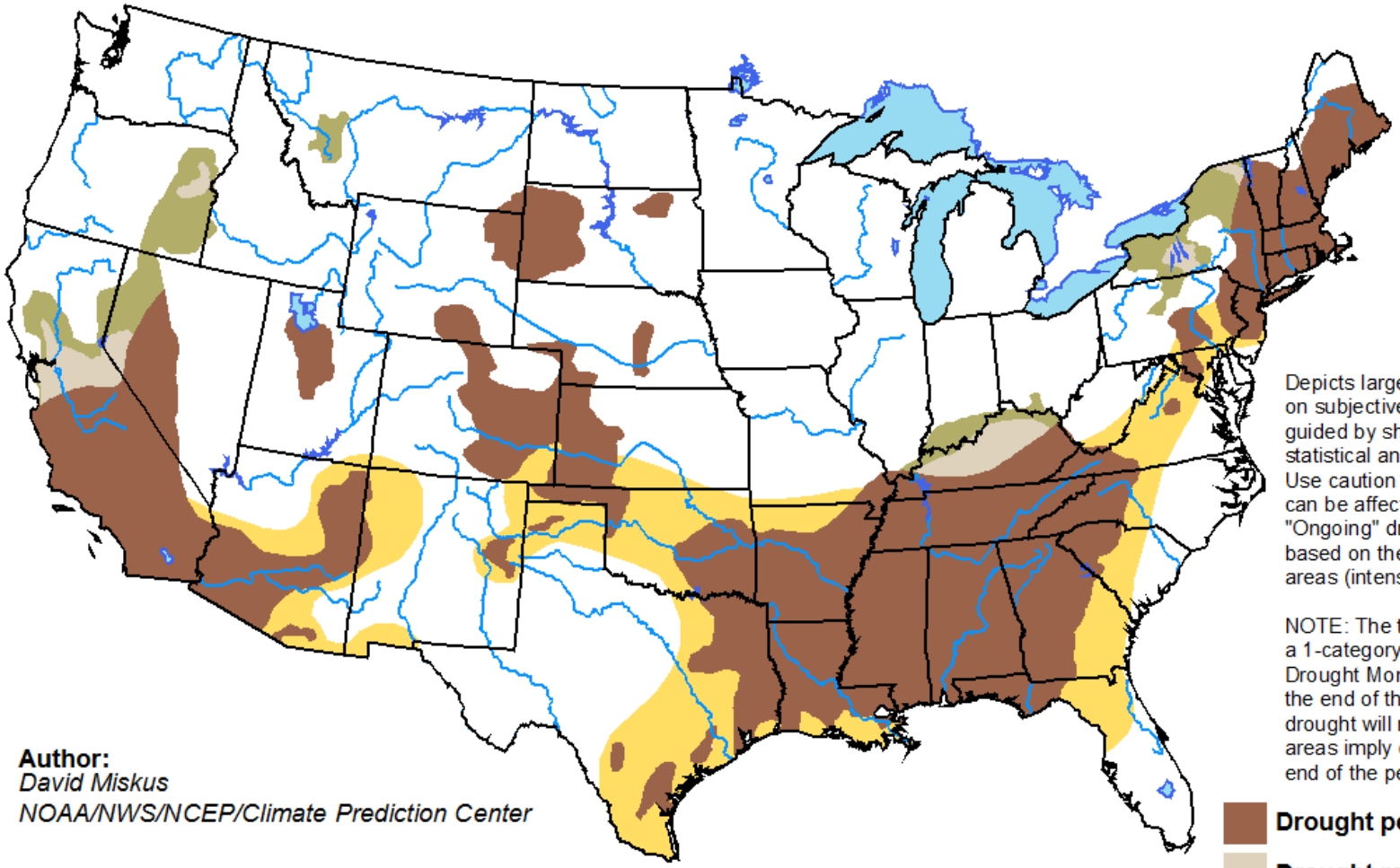
PRECIPITATION

- Winter patterns holds for La Niña
- Wet conditions across the Northern Ohio Valley and Midwest; Dry across the southern States
- No strong signals going into summer and fall



U.S. Seasonal Drought Outlook *Valid for November 17 - February 28, 2017*

Drought Tendency During the Valid Period *Released November 17, 2016*



Author:
David Miskus
NOAA/NWS/NCEP/Climate Prediction Center

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

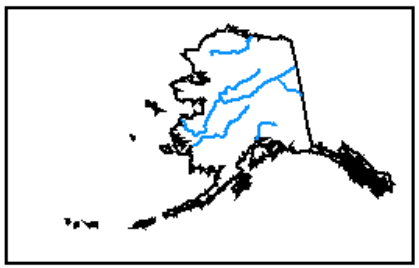
NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

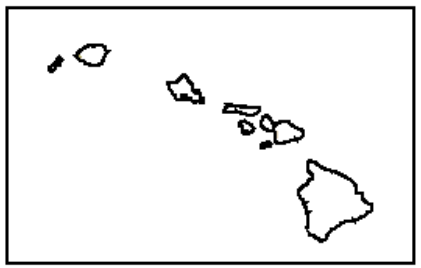
Drought persists

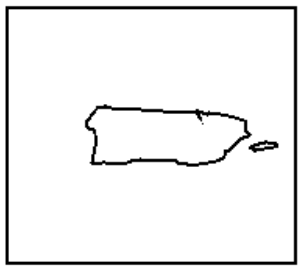
Drought remains but improves

Drought removal likely

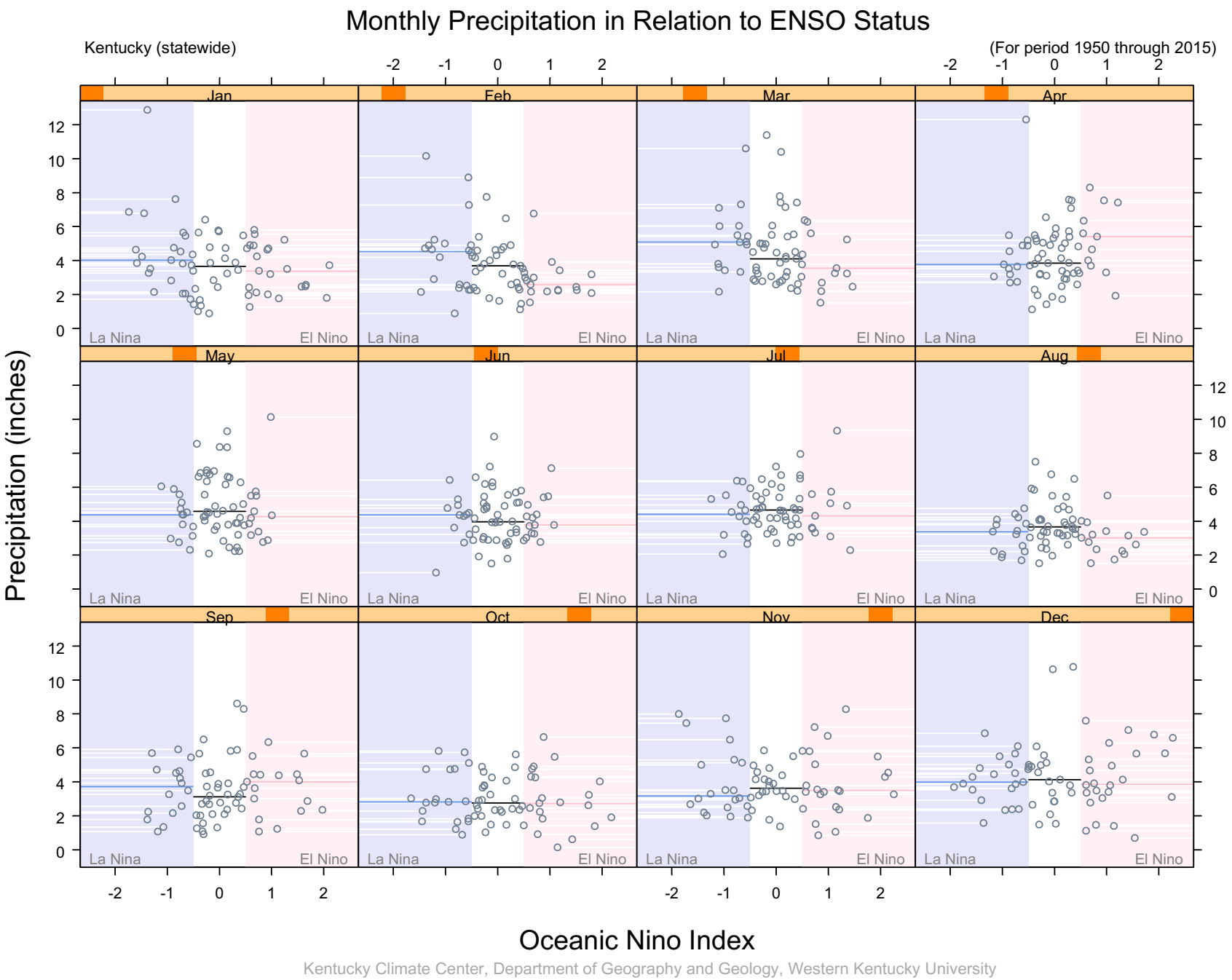
Drought development likely







http://go.usa.gov/3eZ73


Monthly Precipitation in Relation to ENSO Status
Kentucky (statewide)
(For period 1950 through 2015)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
La Nina
El Nino
Precipitation (inches)
Oceanic Nino Index
Kentucky Climate Center, Department of Geography and Geology, Western Kentucky University

Oceanic Niño Index

NOAA/NWS/CPC

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1980	0.6	0.5	0.3	0.4	0.5	0.5	0.3	0.2	0	0.1	0.1	0
1981	-0.2	-0.4	-0.4	-0.3	-0.2	-0.3	-0.3	-0.3	-0.2	-0.1	-0.1	0
1982	0	0.1	0.2	0.5	0.6	0.7	0.8	1.0	1.5	1.9	2.1	2.1
1983	2.1	1.8	1.5	1.2	1.0	0.7	0.3	0	-0.3	-0.6	-0.8	-0.8
1984	-0.5	-0.3	-0.3	-0.4	-0.4	-0.4	-0.3	-0.2	-0.3	-0.6	-0.9	-1.1
1985	-0.9	-0.7	-0.7	-0.7	-0.7	-0.6	-0.4	-0.4	-0.4	-0.3	-0.2	-0.3
1986	-0.4	-0.4	-0.3	-0.2	-0.1	0	0.2	0.4	0.7	0.9	1.0	1.1
1987	1.1	1.2	1.1	1.0	0.9	1.1	1.4	1.6	1.6	1.4	1.2	1.1
1988	0.8	0.5	0.1	-0.3	-0.8	-1.2	-1.2	-1.1	-1.2	-1.4	-1.7	-1.8
1989	-1.6	-1.4	-1.1	-0.9	-0.6	-0.4	-0.3	-0.3	-0.3	-0.3	-0.2	-0.1
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
1990	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.3	0.4	0.4
1991	0.4	0.3	0.2	0.2	0.4	0.6	0.7	0.7	0.7	0.8	1.2	1.4
1992	1.6	1.5	1.4	1.2	1.0	0.8	0.5	0.2	0	-0.1	-0.1	0
1993	0.2	0.3	0.5	0.7	0.8	0.6	0.3	0.2	0.2	0.2	0.1	0.1
1994	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.6	0.9	1.0
1995	0.9	0.7	0.5	0.3	0.2	0	-0.2	-0.5	-0.7	-0.9	-1.0	-0.9
1996	-0.9	-0.7	-0.6	-0.4	-0.2	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5
1997	-0.5	-0.4	-0.2	0.1	0.6	1.0	1.4	1.7	2.0	2.2	2.3	2.3
1998	2.1	1.8	1.4	1.0	0.5	-0.1	-0.7	-1.0	-1.2	-1.2	-1.3	-1.4
1999	-1.4	-1.2	-1.0	-0.9	-0.9	-1.0	-1.0	-1.0	-1.1	-1.2	-1.4	-1.6
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.6	-1.4	-1.1	-0.9	-0.7	-0.7	-0.6	-0.5	-0.6	-0.7	-0.8	-0.8
2001	-0.7	-0.5	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	-0.2	-0.3	-0.4	-0.3
2002	-0.2	0.0	0.1	0.2	0.4	0.6	0.8	0.8	0.9	1.1	1.2	1.1
2003	0.9	0.7	0.4	0	-0.2	-0.1	0.1	0.2	0.2	0.3	0.3	0.3
2004	0.3	0.3	0.2	0.1	0.2	0.3	0.5	0.6	0.7	0.7	0.6	0.7
2005	0.7	0.6	0.5	0.5	0.3	0.2	0	-0.1	0	-0.2	-0.5	-0.7
2006	-0.7	-0.6	-0.4	-0.2	0.0	0.0	0.1	0.3	0.5	0.7	0.9	0.9
2007	0.7	0.4	0.1	-0.1	-0.2	-0.3	-0.4	-0.6	-0.9	-1.1	-1.3	-1.3
2008	-1.4	-1.3	-1.1	-0.9	-0.7	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.7	-0.6	-0.4	-0.1	0.2	0.4	0.5	0.5	0.6	0.9	1.1	1.3
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2010	1.3	1.2	0.9	0.5	0.0	-0.4	-0.9	-1.2	-1.4	-1.5	-1.4	-1.4
2011	-1.3	-1.0	-0.7	-0.5	-0.4	-0.3	-0.3	-0.6	-0.8	-0.9	-1.0	-0.9
2012	-0.7	-0.5	-0.4	-0.4	-0.3	-0.1	0.1	0.3	0.3	0.3	0.1	-0.2
2013	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.3	-0.3	-0.2	-0.3	-0.3	-0.3
2014	-0.5	-0.5	-0.4	-0.2	-0.1	0.0	-0.1	0.0	0.1	0.4	0.5	0.6
2015	0.6	0.5	0.6	0.7	0.8	1.0	1.2	1.4	1.7	2.0	2.2	2.3
2016	2.2	2.0	1.6	1.1	0.6	0.1	-0.3	-0.6	-0.7			

Recent drought episodes impacting Kentucky have been associated with negative index values. La Niña periods are indicated in **blue**.

Symbol indicates drought episode

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml

Cincinnati - Warmest Autumns

Rank	Year	Avg. Temp	Follwing Winter Temp Departure (**)	Following Winter Snow Departure (**)
1	1881	62.5	+7.9°F	N/A
2	1931	61.9	+8.7°F	-12.5"
3	1900	61	-2.5°F	-7.9"
4	2016	60.6	????	????
5	1884	60.2	-6.0°F	N/A
6	1897	60	+1.5°F	-6.0"
7	1941	59.9	+0.1°F	-5.6"
8	1946	59.6	+1.3°F	0.0"
9	2007	59.4	+0.1°F	-1.9"
-	1882	59.4	+0.9°F	N/A

Dayton - Warmest Autums

Rank	Year	Avg. Temp	Follwing Winter Temp Departure (**)	Following Winter Snow Departure (**)
1	1931	60.8	+8.9°F	-16.2"
2	1900	59.5	-1.3°F	-5.9"
3	1927	58.9	+1.2°F	-10.4"
4	2016	58.7	????	????
5	1941	58.2	+0.3°F	-9.4"
6	1946	58.1	+1.1°F	+0.9"
7	1971	58	+1.2°F	-0.6"
8	1973	57.9	+0.8°F	+1.8"
-	1897	57.9	+3.2°F	-5.4"
10	1922	57.7	+1.5°F	-8.8"

Columbus - Warmest Autumns

Rank	Year	Avg. Temp	Follwing Winter Temp Departure (**)	Following Winter Snow Departure (**)
1	1931	60.3	+9.4°F	-17.9"
2	1881	59.8	+7.3°F	N/A
3	2007	59.2	+1.3°F	+2.9"
4	2016	58.9	????	????
5	1927	58.8	+1.4°F	-12.7"
6	1900	58.6	-1.9°F	-7.5"
7	1946	58.5	+0.8°F	-3.8"
-	1941	58.5	+0.5°F	-11.6"
9	2015	57.9	+3.8°F	-7.1"
10	1998	57.7	+4.7°F	+10.1"

(**) - using prior 30-year running average, when available. When not available, using the nearest valid 30-year running average